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**THIS ISSUE CONTAINS:**

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U.S. Department of  
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National Highway  
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Administration



*Shelve in Stacks*

*S.B.T.*

# Highway Safety Literature

...A MONTHLY ABSTRACT JOURNAL

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Documents listed in **Highway Safety Literature** are not available from the National Highway Traffic Safety Administration unless so specified. They must be ordered from the sources indicated on the citations, usually at cost. Ordering information for the most common sources is given below.

**NTIS:** National Technical Information Service, Springfield, Va. 22151.  
**Order by title and accession number:** PB, AD, or HS.

**GPO:** Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Give corporate author, title, personal author, and catalog or stock number.

**Corporate author:** Inquiries should be addressed to the organization listed in the individual citation.

**Reference copy only:** Documents may be examined at the NHTSA Technical Reference Division or borrowed on inter-library loan through your local library.

**See publication:** Articles in journals, papers in proceedings, or chapters in books are found in the publication cited. These publications may be in libraries or purchased from publishers or dealers.

**SAE:** Society of Automotive Engineers, Dept. HSL, 400 Commonwealth Drive, Warrendale, Pa. 15096.  
**Order by title and SAE report number.**

**TRB:** Transportation Research Board, National Academy of Sciences, 2101 Constitution Ave., N.W. Washington, D.C. 20418.

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Technical Services Division (N48-41)  
National Highway Traffic  
Safety Administration  
400 7th Street, S.W.  
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## **ABSTRACT CITATIONS**

## EMISSIONS CONTROL OF ENGINE SYSTEMS. CONSULTANT REPORT

The findings of panels on internal combustion and alternative engines are presented. Primary consideration was given to cost, in terms of fuel consumption, associated with the achievement of various oxides of nitrogen levels by the different engine systems. From the viewpoint of fuel economy, at least on an urban-type driving cycle, the diesel and stratified-charge engines appear most attractive, although potential problems exist with smoke and particulates, odor, noise, and engine performance. The three-way catalyst system with feedback control appears to offer benefits as far as maintainability and drivability are concerned, with only slight loss of fuel economy due to emissions control. Lowering oxides of nitrogen emissions levels from 1.0 to 0.4 g/mi appears to exact a penalty in fuel consumption of up to 35% by excluding the diesel engine. There are no alternative, non-internal combustion engines that could be available in mass production for standard-size automobiles before the 1980's.

by J. E. A. John; N. A. Henein; E. M. Jost; H. K. Newhall; D. Wilfhorst; J. W. Bjerklie; W. J. McLean; C. Tobias; D. G. Wilson

Environmental Protection Agency, Office of Mobile Source  
Air Pollution Control  
1974 ; 272p 240refs

Prepared for the Committee on Motor Vehicle Emissions,  
Commission on Sociotechnical Systems, National Academy of  
Sciences.

Availability: Corporate author

HS-016 499

## AN ANALYSIS OF FARM EQUIPMENT ACCIDENTS ON NORTH CAROLINA PUBLIC ROADS

Driver, vehicle, and environmental (time, weather, roadway, etc.) variables relating to all farm equipment accidents are examined, and variables involving other vehicles are included. The roles of driver licensure and sobriety are studied in detail as they relate to the farm equipment operator. 1972 data were collected and tabulated from accident and driver license files of the North Carolina Department of Motor Vehicles. Farm equipment accidents on public roads are shown to be fair weather crashes, more likely to occur in open country, during daylight hours, on clear days during the work week, and during yearly peak periods of agricultural activity. Farm equipment was found to have more mechanical defects than other vehicles involved in farm equipment collisions, such as improper or nonexistent lighting devices. Almost 50% of all highway collisions involving farm machinery are rear-end, frequently at considerable impact, causing deaths and serious injuries. Changes in procedures governing the use of farm equipment on public highways are recommended.

by J.C. LeGarde  
North Carolina Dept. of Human Resources, Div. of Health  
Services, Raleigh, N. C.  
1975 ; 53p 4refs

Prepared in cooperation with the Univ. of North Carolina  
Hwy. Safety Res. Center, Chapel Hill, and the N. C. Dept. of  
Motor Vehicles.

Availability: Corporate author

## STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. SAFETY IMPLICATIONS PANEL REPORT NO. 2

Fuel economy is discussed as a function of weight, performance, and driving schedule. Traffic control considerations are described. Details are offered on the weight versus safety tradeoff, including weight impact of current and anticipated future safety standards, accident study results, and materials substitutions. The effect of speed limits on fuel economy and safety is also examined. Tentative conclusions are that changes in travel exposure have uniformly reduced accidents and associated injuries by approximately 14%; that lower speeds are having a large effect in the additional reduction of 12% in fatalities and 20% in serious injuries; and that the reduced injury severity occurred primarily in multiple vehicle crashes.

Department of Transportation; Environmental Protection  
Agency

Rept. No. R-2 ; 1975 ; 43p 10refs

Rept. No. 2 of 7.

Availability: Corporate authors

HS-016 501

## STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. TRUCK AND BUS PANEL REPORT NO. 7

Analyses of available data indicate that fuel economy improvements for some individual trucks can be as great as 41% by the 1980 production year. Assessment of such technology applied without cost or production capacity restraint would yield an aggregate reduction of 25% in the fuel consumed by the new trucks and buses manufactured in 1980. When considerations of cost benefit tradeoffs to the purchaser and production capacity by 1980 are taken into account, the maximum fuel savings for the new 1980 vehicles drops to 18%. If weight, length, and configuration limits imposed upon truck operations by federal and state law were unified and certain recommended changes made, a reduction in heavy duty truck fuel consumption equivalent to that expected from advanced technology could be realized. The most significant payoff technology options include: increased utilization of diesel engines; optimized cooling systems; radial tires and engine power and speed derating. No environmental or safety degradation could be identified with the suggested technology options. The major technological shortcoming identified lies in the realm of viable and equitable fuel economy measurement techniques. High priority needs to be given to the development of fuel economy test procedures. Since the real efficiency of the commercial vehicle fleet is determined by the fuel consumed relative to the work performed (transportation of material and people), the final measure of commercial vehicle fuel economy should reflect productivity in ton miles or passenger miles per gallon of fuel consumed.

Department of Transportation; Environmental Protection  
Agency

Rept. No. R-7 ; 1975 ; 112p refs

Rept. No. 7 of 7.

Availability: Corporate authors

HS-016 502

# **MANUFACTURABILITY AND COSTS OF PROPOSED LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS. CONSULTANT REPORT**

The capability of the U.S. automotive industry to produce a variety of alternative emissions technology is assessed, and the associated fuel, maintenance, sticker price, and investment-cost penalties to the driving public are examined. The industry is seen as more dynamic, difficult and uncertain in the late 1970's than earlier in the decade. The solutions used through model year 1974 to reduce emissions have been extremely costly to the American driving public. The oxidizing catalytic converter substantially eliminates in 1975 model year cars the earlier fuel-economy penalty. Public acceptance is a major unanswered question. One dominant short-term concern from 1975 to 1980 will be the shift to smaller cars with improved gasoline economy. Cost increase estimates are given for implementation of proposed exhaust emission laws, and the outlook for the catalytic converter is discussed. Separate emissions regulations and test procedures for automotive diesel cars are advocated.

by L. H. Lindgren; M. Ebner; H. A. Gay; W. A. Johnson; J. Kittrell; C. R. Maxwell  
Environmental Protection Agency, Office of Mobile Source Air Pollution Control  
1974 ; 326p 14refs  
Prepared for the Committee on Motor Vehicle Emissions  
Commission on Sociotechnical Systems, National Academy of Sciences.  
Availability: Corporate author

HS-016 503

# **OPTIMALES ABBREMSEN EINES FAHRZEUGES BEI KURVENFAHRT (OPTIMAL VEHICLE BRAKING DURING A TURN)**

The problem of minimizing the stopping distance of a vehicle along a given trajectory is considered. A simple one-wheel-model for the vehicle and a suitable performance index for the optimization problem are derived. A simplified problem is considered first from which an analytical solution for the optimal trajectory is obtained. The suboptimal open loop control inputs are then approximately computed via a search algorithm. The results show that the performance nearly matches the predicted value.

by R. Swik  
Publ: VEHICLE SYSTEM DYNAMICS v3 n4 p193-215 (Dec 1974)  
1974 ; 8refs  
Text in German. English summary.  
Availability: See publication

HS-016 504

# **VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTER VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON**

## **THE DIRECTIONAL DYNAMICS OF TRACTOR-SEMITRAILER VEHICLES)**

Some results of theoretical and experimental investigations on the dynamic directional properties of heavy tractor-semitrailer vehicles are presented. A nonlinear digital computer model was developed on which the theoretical system analysis is based. This model takes into account the nonlinear tire properties and the friction couple of the fifth wheel. A combination of numerical computation methods (Runge-Kutta and Newton-Raphson techniques) is used for the digital computer simulation. Full scale road tests with articulated vehicles of 38 ton total weight were conducted for experimental validation of the theoretical model. As input signals to the vehicle, predetermined steering wheel angle functions were used. The system output signals corresponding to these input functions were measured and stored. A comparison of the obtained theoretical and experimental results shows a very good qualitative agreement and leads to the conclusion that the developed theoretical model can give consistent estimates of the basic dynamic vehicle properties.

by E. Bisimich; M. Mitschke  
Publ: VEHICLE SYSTEM DYNAMICS v3 n4 p217-51 (Dec 1974)  
1974 ; 25refs  
Text in German. English summary.  
Availability: See publication

HS-016 505

# **DEADLY DRIVING HABITS. 104 YEAR OLD RESOLVES TO QUIT SPEEDING**

The survival chances of speeding drivers are discussed along with other bad driving habits that cause accidents and injury. Examples include driving while under the influence of alcohol or drugs, driving while angry or emotionally disturbed, tail-gating, changing lanes without signalling, making turns from the wrong lane, failing to make boulevard stops, disregarding roadside signs or signals, drowsiness, day dreaming, talking with passengers, running out of gas, driving too close to the center line, driving with windows tightly closed, and poor vision. Case studies of some of the examples are cited, and public acceptance of the 55 mph speed limit is discussed.

by W. L. Roper  
Publ: CALIFORNIA HIGHWAY PATROLMAN v39 n2 p4,5,20,21,24,25,28-30 (Apr 1975)  
1975  
Availability: See publication

HS-016 506

# **HUMAN TOLERANCE RESEARCH PROGRAM. FIRST YEAR INTERIM REPORT**

Progress during the first year of a two-year program on advanced research in human impact tolerance is discussed. Relationships between linear and angular impacts of various intensity and direction to the head and the resulting injuries are examined, along with effective principal moments of inertia of the head in rotation, tolerance of the femur to longitudinal and transverse impact, and tolerance of the tibia and fibula to transverse impact. The test subjects were all unembalmed human cadavers. A unique feature of the program is the use of sufficient instrumentation to determine the three dimensional

motion of the head both during impact and in the motion that follows. Many special techniques were developed, and the appropriate test fixtures designed and built. The details of these techniques and fixtures are given. The advantage of such complete instrumentation is that the data on head motion produced in each test can be reduced to give the linear and angular accelerations of any point within the head and can be re-calculated at a different point at a later date. The experimental techniques are discussed, and results of preliminary tests performed during the first year of the program are presented.

by R. L. Stalnaker; J. W. Melvin  
University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy.  
and Baxter Rd., Ann Arbor, Mich. 48105  
Rept. No. UM-HSRI-BI-74-3; VRI-8.2; 1974; 80p  
Report for 15 Apr 1973-15 May 1974.  
Availability: SAE

HS-016 507

### PROD: CARING FOR DRIVERS

The Professional Drivers' Council for Safety and Health (PROD) is described with emphasis on its lobbying success in defense of professional truck drivers. The group is a spin-off of one of Ralph Nader's organizations and is led by an experienced labor lawyer. Legislative accomplishments of the group are reviewed.

by J. Strickland  
Publ: COMMERCIAL CAR JOURNAL v128 n3 p102-6 (Nov 1974)  
1974; 5p  
Availability: See publication

HS-016 508

### READING THE HIGHWAY...FIGHTING FATIGUE

Suggestions on defensive driving and fighting fatigue for truck drivers are offered. Examples are cited of avoiding drunk drivers, dealing with improperly signalled turnoffs, and passing vehicles. Driver characteristics and behavior are described which may indicate future unpredictable maneuvers. Indications that show a driver's need for a rest stop or sleep are also discussed, including the hazards of hallucinations. Many popular methods of staying awake are exposed as useless or dangerous.

by E. D. Fales, Jr.  
Publ: COMMERCIAL CAR JOURNAL v128 n3 p114-20 (Nov 1974)

Availability: See publication

HS-016 509

### DRIVER EDUCATION IN CLEVELAND PUBLIC AND NON-PUBLIC SCHOOLS AND APPENDICES (REFERENCES). UTILIZING PARAPROFESSIONAL PERSONNEL AS ROADWORK INSTRUCTORS

Driver education programs and instructors in Ohio are described with emphasis on the use of paraprofessionals for roadwork instruction. Their legal status is reviewed, along with

requirements and certification, screening and hiring, pay scale and daily time, training schedules and in-service training, and supervision. Instructional aids and guidelines are presented. The Cleveland driver education program is evaluated, with appendices included on standard operating procedures and a guide for instructors in the Cleveland public schools, and the Driver Education Roadwork Guide. Checklists for the student driver evaluations are given.

by H. G. Seitz  
Cleveland Public Schools, Driver Education Div., 1380 E. 6th St., Cleveland, Ohio 44114  
1974; 32p  
Availability: Corporate author

HS-016 511

### THE EFFECTS OF AUTOMOBILE SAFETY REGULATION

Some of the evidence supporting the effectiveness of safety regulations of automobile safety is reviewed and it is concluded that such regulation has had no effect on the highway death toll. There is some evidence that regulation may have increased the share of this toll borne by pedestrians and increased the total number of accidents. Major design changes affected by the regulations include seatbelts for all occupants, energy absorbing steering column, penetration-resistant windshield, dual-braking system, and padded instrument panel. The variables of alcohol, youth, and speed are examined as they affect accident statistics. A time series analysis is offered, and the political demand for safety legislation is discussed. The time series data imply that safety regulation has not merely reflected market forces, for then its failure to reduce the highway death rate should have been matched by failure to change the distribution of these deaths. Injury and property damage experience is reviewed along with evidence on driver behavior, for corroboration of this inference. The related influence of driver risk taking behavior is explored.

by S. Peltzman  
University of Chicago, Graduate School of Business, 5836 Greenwood Ave., Chicago, Ill. 60637  
1974; 92p 29refs  
Submitted for publication in JOURNAL OF POLITICAL ECONOMY, Aug. 1975.  
Availability: Corporate author

HS-016 512

### ONE TOO MANY FOR THE ROAD [DRINKING DRIVERS]

The reality of being arrested for drunk driving in California is described. The description is an attempt to warn of the trouble, cost, and humiliation that results. Photographs are included showing driver contact with police, arrest, flunking a field sobriety test and a chemical test. The importance of arresting drunk drivers is emphasized.

by C. Barnett  
Publ: DRIVER v8 n11 p1,3-9 (Apr 1975)  
1975  
Availability: See publication

HS-016 513

**ENGINE SILENCING--CHANGES IN EMPHASIS**

The current position of engineers in exhaust silencing is outlined, and implications of new legislation are discussed. Muffler design problems are examined which are created by the demand for smaller cars with low frontal areas; small engines can produce more power only by increasing the throughput of gas and subsequently increasing noise. Design procedures are reviewed and difficulties in prescribing statutory tests for checking vehicle noise are noted. Future requirements are also discussed with regard to back pressure and exhaust pipe sizing.

by K. Garrett

Publ: ENGINEERING v215 n3 p214-7 (Mar 1975)

1975 ; 6refs

Availability: See publication

HS-016 514

**FIELD PERFORMANCE OF EMISSIONS-CONTROLLED AUTOMOBILES. CONSULTANT REPORT TO THE COMMITTEE ON MOTOR VEHICLE EMISSIONS. COMMISSION ON SOCIOTECHNICAL SYSTEMS, NATIONAL RESEARCH COUNCIL**

The probability that the 1975-76 cars will meet the exhaust emissions standards in actual use in customers' hands is examined. Results of certification tests, fleet test data, component improvements, and the effect of unleaded fuel are considered, and it is concluded that the standards can be met. The probability that the cars will receive proper maintenance is examined in terms of the present state of the service industry and the availability of regimes for enforcing proper maintenance, and it is concluded that they will not receive proper maintenance because the service industry is inadequate and means for enforcing proper maintenance do not exist. It is generally concluded that the 1975-76 cars will not meet the standards in actual use, although they will come closer than other recent model cars. Analysis of the sensitivity of emissions to the presence of untreated exhaust shows that proper maintenance will become more essential for meeting the standards as the standards become stricter. Fundamental social attitudes, not technical difficulties, are shown to be the major hindrance in improving the service industry and enforcement of proper maintenance. The effects of component reliability and the use of unleaded fuel on maintenance required are evaluated, and found to be the major reasons why 1975-1976 cars will come closer to meeting standards than recent cars. An analysis of alternatives to the gasoline internal combustion engine is given, and none of the near-term alternatives are shown to offer significant advantages.

by R. R. Brattain; J. L. Gockel; D. J. McDowell  
Environmental Protection Agency, Office of Mobile Source  
Air Pollution Control, Washington, D.C.

1974 ; 80p 27refs

Availability: Corporate author

HS-016 515

**LARGE-TRUCK ACCIDENTS INVOLVING TIRE FAILURE**

Truck accidents involving truck tire failure are examined by reviewing existing literature, interviewing local cargo haulers, and analyzing several computerized accident data files. Such accidents are shown to account for between 0.68% and 0.82% of all truck accidents in the U.S. Similar data reported by two specific cargo haulers show that truck accidents involving truck tire failure account for 0.43% to 0.75% of all their recorded accidents, and that a truck accident involving truck tire failure occurs about once in every 10 to 17 million truck vehicle miles. Only about one truck tire failure in 1300 to 2200 of such failures results in an accident. HSRI data indicate that truck accidents involving truck tire failure constitute from 0.02% of all accidents in Texas to an average of about 0.9% of all accidents on the Indiana, Ohio, and Pennsylvania Turnpikes. Such accidents account for about 0.9% of all truck accidents in Texas and average about 4.4% of all truck accidents on those turnpikes. Truck accidents involving front tire failures usually are a consequence of loss of control. From 85% to 99% of such accidents involve just one vehicle. Accidents involving trailer-tire failures almost always involve a tire fire. In general, truck accidents involving tire failure were found to be so rare as to make only a minor contribution to the total body of accident statistics.

by D. F. Dunlap; J. O'Day

Publ: HIT LAB REPORTS v5 n6 p1-16 (Feb 1975)

1975 ; 11refs

Availability: University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy. and Baxter Rd., Ann Arbor, Mich. 48105

HS-016 516

**THE PHYSICS OF TIRE TRACTION. THEORY AND EXPERIMENT**

Papers, panel discussions and general discussions from a symposium on the physics of tire traction are presented. Topics covered include: tire wet traction; tire hydroplaning; tire traction on dry uncontaminated surfaces; tire traction on snow-covered pavements; speed and temperature dependence of rubber friction and its bearing on the skid resistance of tires; sliding rubber; lubrication studies of smooth rubber contacts; wet skid resistance; rubber friction; tread compound; tread pattern; dynamics and frictional behavior of pneumatic tires; traction physics; the relation between the stress saturation of sliding rubber and the load dependence of road tire friction; pavement surface texture classification and skid resistance (photo-interpretation); pavement textural characteristics required for optimum performance of the tire; analysis of the literature of tire-road skid resistance.

by D. F. Hays, ed.; A. L. Browne, ed.

General Motors Res. Labs.

1974 ; 428p 258refs

Proceedings of the Symposium on The Physics of Tire Traction held at the General Motors Res. Labs., Warren, Mich., Oct 8-9, 1973.

Availability: Plenum Press, 227 West 17th St., New York, N.Y.



HS-016 517

# **THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE AS A MODE OF TRANSPORTATION AND RECREATION. ATLANTA METROPOLITAN REGION**

Basic trends and policy issues regarding bicycle facility development and programs in the Atlanta metropolitan area are examined. A conceptual regional plan is described, along with investment strategies and an evolving bicycle program. A proposed demonstration project is outlined for Atlanta which illustrates what ILLUSTRATES WHAT a higher order facility might do to accommodate and promote bicycle activity within the region.

Barton-Aschman Associates, Inc., 1771 W. Howard St., Chicago, Ill. 60626  
1974 ; 70p 33refs  
Prepared for the Atlanta Regional Commission, Ga. Dept. of Transportation,  
Availability: Corporate author

HS-016 518

# **THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE AS A MODE OF TRANSPORTATION AND RECREATION. ATLANTA METROPOLITAN REGION. TECHNICAL APPENDIX**

Materials are included which were considered to be most helpful to local officials who are interested in details regarding the development of bicycling programs and facilities. The appendices include: status of bicycle facility development in cities and states; funding sources; significant bicycle legislation; examples of bicycle racks; memorandum of legal issues regarding bicycle facility development in Georgia; costs of bicycle facility development; existing local bike routes; intersection treatments; bicycle safety rules; case examples of bicycle registration and licensing; standard signs; participants in Atlanta regional bicycle facility meetings; and a bibliography.

Barton-Aschman Associates, Inc., 1771 W. Howard St., Chicago, Ill. 60626  
1974 ; 116p refs  
Prepared for Atlanta Regional Commission, Ga. Dept. of Transportation.  
Availability: Corporate author

HS-016 519

# **AUTOMOTIVE ELECTRONICS 2**

Status reports on the application of electronics to the automobile throughout the world are presented, and the experience of a supplier company in meeting the demands of the automotive market is discussed. Tutorial definitions and descriptions of microprocessors are given, along with discussions of current progress in the application of microprocessors to the automobile. Electronic display technology is reviewed, design parameters relevant to automotive usage are discussed, and engineering considerations in designing display systems are described. Closed loop control is considered in terms of control of engine air-fuel ratio with primary emphasis on exhaust emissions, and in terms of fuel consumption minimization. Reliability and

electronic design problems associated with restraint systems are also discussed.

Society of Automotive Engineers, Inc., 400 Commonwealth Dr., Warrendale, Pa. 15096  
Rept. No. IEEE-75CH0976-1VT; SAE-SP-393 ; 1975 ; 203p 117refs

Includes HS-016 520--HS-016 536. Includes papers presented at 1975 SAE International Congress, Detroit, Feb. 24-8.  
Availability: SAE

HS-016 520

# **PROGRESS IN AUTOMOTIVE ELECTRONICS**

This paper was originally presented at CONVERGENCE '74 International Colloquium on Automotive Electronic Technology, October 28-30, 1974 under the title, "The Challenge of Automotive Electronics in the U.S.A." It is available as part of the Colloquium Proceedings (P-57) from the SAE or 74CH0928-2VT from the IEEE.

by T. O. Jones; L. L. Bowler  
General Motors Corp.  
Publ: HS-016 519, SAE-SP-393; IEEE-75CH0976 - 1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p3  
Rept. No. SAE-750199 ; 1975  
Availability: In HS-016 519

HS-016 521

# **ELECTRONIC EQUIPMENT EARNING ITS PLACE ON EUROPEAN VEHICLES**

The development of European vehicle electronics is traced from 1960 to the present. The approximate current rates of production of alternator regulators, tachometers, fuel injection controllers and ignition equipments are quoted. Analysis of the development of a product design of an alternator regulator is carried out and reference made to some ways of achieving high reliability in the hostile underhood environment. The impact of legislation on the emergence of electronic ignition is discussed. Some likely effects of device evolution on current design are mentioned and pointers given to the expected pattern of future developments for European vehicle electronics.

by C. S. Rayner  
Circuitry, The Lucas Electrical Co. Ltd., Shirley, West Midlands, England  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p5-11  
Rept. No. SAE-750200 ; 1975 ; 5refs  
Availability: In HS-016 519

HS-016 522

# **ELECTRONIC EQUIPMENT USAGE ON JAPANESE VEHICLES**

The use of electronic systems for automobile safety and air pollution control regulations adherence is described. Differences between the U.S. and Japanese standards are noted, and consideration is given to the influence of the Honda CVCC engines which require no electronic control systems to satisfy severe emission standards. Cooperative efforts between automobile and electronic component manufacturers are discussed. Development of new techniques to apply electronic systems to a number of applications within the automotive

system, such as in-transit communication, diagnostic systems, and accident prevention, are the goals sought through the cooperation between both industries.

by G. P. Lemberg  
International Quantum Science Corp., Palo Alto, Calif.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p13-41  
Rept. No. SAE-750201; 1975  
Availability: In HS-016 519

HS-016 523

## **AUTO ELECTRONICS: A SEMICONDUCTOR SUPPLIER'S VIEWPOINT**

Steps taken by the semiconductor industry to be responsive to the requirements of the automotive industry are reviewed, with special emphasis on one recently developed and highly cost-effective method to control and improve device reliability. Two new product innovations, one combining MOS semiconductor and bipolar technology to produce a high performance and versatile operational amplifier integrated circuit, and the other an inherently more reliable process for integrated circuit manufacture involving a hermetic silicon die and a corrosion resistant lead connection system are also described, particularly as they relate to automotive applications.

by R. M. Cohen  
Quality and Reliability Assurance, RCA, Sommerville, N.J.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p43-8  
Rept. No. SAE-750202; 1975; 5refs  
Availability: In HS-016 519

HS-016 524

## **WHAT IS A MICROPROCESSOR?**

A microprocessor is described as a device capable of automatically carrying out a sequence of operations on data expressed in discrete (digital) or continuous (analog) form. It solves a problem or class of problems of control, analysis, or a combination of the two. Its advantage is time. On a series of complex analytical problems, a mathematician could dedicate his entire life to doing what a computer could do in mere seconds; and no human could continuously analyze new stimuli and generate responses in the microsecond intervals required by modern electronics and electromechanical hardware. Software and programming language, and the advantages and disadvantages of using the microprocessor are discussed.

by J. BouFaissal  
National Semiconductor Corp.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p51-63  
Rept. No. SAE-750431; 1975  
Availability: In HS-016 519

HS-016 525

## **APPLICATION OF MICROPROCESSORS TO THE AUTOMOBILE**

Microprocessor technology is described as it may be applied to the automobiles of the future. The microprocessor require-

digital 4-bit, microprocessor to perform several vehicle control and display functions. The development of the system encompassed not only the interface circuit design and microprocessor programming, but also the derivation of the digital algorithms and control laws for the functions which have traditionally been performed in an analog fashion. The control functions performed include: cruise control; four-wheel-lock control; traction control; speed warning; ignition spark advance and dwell; automatic door locks; and anti-theft system. The display functions include: speedometer (both analog and digital), odometer, tachometer, clock, and elapsed time.

by T. O. Jones; T. R. Schlax; R. L. Colling  
General Motors Corp., Warren, Mich.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p65-74  
Rept. No. SAE-750432; 1975  
Availability: In HS-016 519

HS-016 526

## **ENGINE CONTROL BY AN ON-BOARD COMPUTER**

A spark ignited internal combustion engine with computer controlled spark and exhaust gas recirculation (EGR) has been operated over the CVS test cycle. At the 1975 emission level, a 10-20% improvement in fuel economy on the test vehicle over the initial production 1975 California vehicle was measured. Comparable driveability, octane, emission levels, and performance were obtained. The initial calibration for the control of spark and EGR was developed from engine dynamometer testing; and computer simulations allowed for calibration development prior to vehicle implementation. Cost effectiveness questions have not been resolved.

by D. F. Moyer; S. M. Mangrulkar  
Ford Motor Co., Systems Res. Lab., Dearborn, Mich.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p75-78  
Rept. No. SAE-750433; 1975; 4refs  
Availability: In HS-016 519

HS-016 527

## **DESIGN CONSIDERATIONS FOR AN ON-BOARD COMPUTER SYSTEM**

A programmable digital logic system has been developed for vehicle powertrain control. The system is configured around a custom microcomputer, and has been demonstrated in the control of ignition timing and exhaust gas recirculation rate in vehicle installation. The specific design resulted from considerations of performance, reliability, serviceability, flexibility, and cost. This work at Ford has made further contribution to establishing the feasibility of an on-board computer system for vehicle application, but direct cost effectiveness is not yet established, and many problems remain unresolved.

by R. S. Oswald; N. L. Laurance; S. S. Devlin  
Ford Motor Co., Systems Res. Lab., Dearborn, Mich.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p79-84  
Rept. No. SAE-750434; 1975; 11refs  
Availability: In HS-016 519

October 31, 1975

HS-016 533

HS-016 528

## **SURVEY OF ELECTRONIC DISPLAYS**

The various types of electronic displays that are available now or are being investigated in research laboratories are surveyed. The review is limited to small or medium sized displays which might be suitable for automotive dashboard displays, including: light emitting diodes, planar gas discharge, incandescent, vacuum fluorescent, electroluminescent, and liquid crystal displays, as well as some other types of displays which, although not commercially available at present in quantity, are being actively investigated. The discussion includes such topics as the distinction between active and passive displays and the advantages and limitations of each type, the principles of operation of the various types of displays, and their electrical and optical characteristics.

by J. F. Nolan  
Owens Illinois Technical Center, Toledo, Ohio  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p87-100  
Rept. No. SAE-750364; 1975; 42refs  
Availability: In HS-016 519

HS-016 529

## **ELECTRONIC DISPLAY SYSTEMS IN THE AUTOMOBILE**

Automotive design and requirements for electronic digital displays are examined, including light emitting, light reflecting, and light absorbing technologies. The drive circuits, interconnects, and dimming aspects are considered as part of automotive requirements. Several digital display system techniques fundamental to an effective display are presented with examples for speed and fuel displays.

by M. U. Trenne; J. J. Stephan  
General Motors Corp., General Motors Technical Center, Warren, Mich.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p101-7  
Rept. No. SAE-750365; 1975; 11refs  
Availability: In HS-016 519

HS-016 530

## **ELECTRONIC DISPLAY APPLICATIONS IN INSTRUMENT PANEL DESIGN**

In view of the expanding role of electronic displays, or solid state and plasma displays controlled electronically, the instrument panel design process in the automotive vehicle is described. Ways in which electronic displays can assist in dealing with the major design problems of the vehicle are examined. Advantages of electronic displays are discussed with regard to serviceability, reliability, and overall appearance of the instrument panel area. Primary considerations influencing the overall design are the human factors requirements of the driver and the physical location of the components in the area.

design to utilize this new technology more effectively as applications broaden within the industry.

by H. Nissley; R. J. Boike  
Ford Motor Co., Instrument Panel Package and Design, Dearborn, Mich.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p109-21  
Rept. No. SAE-750366; 1975  
Availability: In HS-016 519

HS-016 531

## **TECHNIQUES FOR DRIVING DIGITAL DISPLAYS**

With the growing importance of digital electronics, the need for methods for displaying digital information has grown. Several technologies for information display devices presently exist or appear to be likely prospects for future commercial development. The systems designer is often faced with the problem of providing an electronic interface between the digital system and the display device. Solutions to the problem of designing the interface electronic circuitry are offered. Particular attention is paid to integrated circuits available for this application.

by G. R. Seaton; D. A. Wayne  
Dionics Inc., Westbury, N. Y.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p123-33  
Rept. No. SAE-750367; 1975; 10refs  
Availability: In HS-016 519

HS-016 532

## **BOSCH ELECTRONIC FUEL INJECTION WITH CLOSED LOOP CONTROL**

A second generation electronic fuel injection system with improved performance is described. This is achieved by basic system considerations as well as by sophisticated electronics design making use of custom designed bipolar integrated circuits. By using an oxygen sensor, it is possible to detect the stoichiometric mixture and to use a closed loop control to meet the proposed U. S. Federal Emission Standards of 1978. The basic electronic design, closed loop control, and oxygen sensor are described.

by I. Gorille; R. Rittmannsberger; P. Werner  
Robert Bosch GmbH, Electronics Div., Schwieberdingen, Germany  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p137-44  
Rept. No. SAE-750368; 1975; 7refs  
Availability: In HS-016 519

HS-016 533

## **CLOSED LOOP CARBURETOR EMISSION CONTROL SYSTEM**

electronic control logic, and emission test results with a low mileage three-way converter are set forth.

by R. A. Spilski; W. D. Creps  
Chevrolet Engineering Center, Warren, Mich.; General Motors  
Res. Lab., Warren, Mich.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p145-54  
Rept. No. SAE-750371 ; 1975 ; 7refs  
Availability: In HS-016 519

HS-016 534

## **ELECTRONIC OPTIMIZER CONTROL FOR I. C. ENGINE: MOST MPG FOR ANY MPH**

The optimizer is discussed as an electronic control system that keeps the engine in tune all the time by adjusting its setting continuously for best fuel economy several times each second. In contrast to the conventional programmed controls, the optimizer works on the closed-loop principle in which the output influences the input. It has been applied to setting the spark timing and air-fuel ratio in automobile engines and injection timing in diesel engines. Optimizer control is applicable to the adjustment of any setting in any prime mover: right-left, up-down, clockwise-counter clockwise, which influences the power output. The dramatic advance in microelectronics in the last few years permits the application of optimizer controls to conventional automobile engines at an amazingly low manufacturing cost.

by P. H. Schweitzer; C. Volz  
Optimizer Control Corp., State Coll., Pa.; Penn State Univ.,  
Electrical Engineering Dept., State Coll., Pa.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p155-81  
Rept. No. SAE-750370 ; 1975 ; 18refs  
Availability: In HS-016 519

HS-016 535

## **ELECTRONIC FAULT MONITORING AND DIAGNOSIS IN AIR BAG SYSTEMS**

A very high level of confidence must be maintained at all times that the air bag passive restraint system and each of its components are in proper operating condition to function as required. Electronic circuitry which continuously performs non-destructive testing is used to monitor the system components, connectors, and wiring integrity. This fail-safe circuitry, which incorporates self-check features, causes a fault indicator to become illuminated should a fault exist in any part of the air bag system. A fault analyzer, which pinpoints the exact location and nature of a fault, is available for system servicing and/or system final assembly verification.

by M. S. Balban  
Eaton Corp., Safety Systems Div., Troy, Mich.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p185-96  
Rept. No. SAE-750436 ; 1975  
Availability: In HS-016 519

HS-016 536

## **FUNDAMENTALS OF AUTOMOTIVE ELECTRICAL DISTRIBUTION**

The challenge of the design of a cost effective, highly reliable electrical distribution system for the automobile is discussed. A point of reference to the electronic designer is provided by examining key factors in the development of an electrical distribution system for a modern car. Primary emphasis is devoted to the design of a fault protected distribution network that is compatible with the state-of-the-art in automotive component design and assembly processes.

by J. A. Foreman  
Ford Motor Co., Advanced Vehicles Engineering, Dearborn, Mich.  
Publ: HS-016 519 (SAE-SP-393; IEEE-75CH0976-1VT)  
AUTOMOTIVE ELECTRONICS 2, Warrendale, 1975 p197-203  
Rept. No. SAE-750438 ; 1975 ; 4refs  
Availability: In HS-016 519

HS-016 537

## **THE MECHANICS OF ROLLOVER AS THE RESULT OF CURB IMPACT**

The mechanics of overturning which occurs as the result of vehicle colliding with a curb or similar obstacle is examined. Because the duration of impact is short, the forces involved may be treated as impulsive forces and a graphical method may be used to determine the terminal velocities after the impact. The mathematical analysis is supported by results obtained from a film of an actual track test in which rollover was induced by sliding a car sideways into a curb. The motion of the vehicle after impact with the curb was also analyzed in the film. During airborne motion, the car may be considered as a simple projectile and any aerodynamic effects neglected.

by I. S. Jones  
Calspan Corp.  
Rept. No. SAE-750461 ; 1975 ; 6p 5refs  
Presented at Automotive Engineering Congress and Exposition, Detroit, Feb 24-28, 1975  
Availability: SAE

HS-016 538

## **GUIDELINES ON THE OPERATION OF SUBSCRIPTION BUS SERVICES**

The planning, organization, and operation of specialized bus services, termed subscription, which are tailored to serve urban travelers who agree to patronize them on a regular basis, are described. Based on 10 detailed case studies of such services, the report develops guidelines on identifying and informing potential riders, obtaining vehicles and drivers, meeting regulatory requirements, setting routes, schedules, fares, and obtaining special privileges such as the use of express lanes and close-in parking. The potential impacts these services on the congestion, pollution, and fuel consumption associated with urban travel are reviewed.

by R. F. Kirby; K. U. Bhatt  
The Urban Inst., 2100 M St., N.W., Washington, D. C. 20037  
Contract DOT-UT-40008

HS-016 539

# **FOR MORE SAFETY ON OUR ROADS. THE ROAD SAFETY PROGRAMME (PROGRAM) OF THE FEDERAL REPUBLIC OF GERMANY. "PEOPLE HAVE THE RIGHT OF WAY"**

The pros and cons of individual topical issues concerning road safety are reviewed. Focus is on the impact of the automobile on the quality of life, past efforts at road safety, speed limits and safety belt installation, blood alcohol levels, cost effectiveness, and road safety responsibilities. Chapters are dedicated to the topics of traffic enlightenment and education, driver licensing, traffic regulations and other standards, design and equipment standards for motor vehicles, road construction and traffic engineering, emergency services, and research. Detailed statistics on road accidents and casualties are given in an appendix.

Federal Transport Ministry, Bundesminister Fur Verkehr (BMV) Bonn, Germany  
1973 ; 105p  
Availability: Corporate author

HS-016 540

# **ALCOHOL AND HEALTH. SECOND SPECIAL REPORT TO THE U. S. CONGRESS, JUNE 1974, FROM THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE. NEW KNOWLEDGE**

New approaches to alcohol and alcoholism are recommended, with emphasis on particular actions and programs involving the partnership of government with private enterprise and citizen groups. It is found that: alcohol abuse occurs at high incidence rates in the U.S.; youth drinking is increasing; there is public ignorance about alcoholism; the economic cost of alcohol abuse is \$25 billion per year; and the U.S. system of alcohol controls is ineffective. The heredity and congenital effects of alcohol are discussed, along with specific health consequences, such as impact on cancer, the heart, liver disorders, mortality, and the central nervous system. Its role in highway accidents is reviewed, and further consideration is given to trends in treatment of alcoholism, problem drinkers on the job, alcoholism and health insurance, and the enhancement of health. An appendix is included on the prevention of alcoholism in the U.S. using cultural and educational forces.

by M. Keller, ed.  
Department of Health, Education and Welfare, National Inst. on Alcohol Abuse and Alcoholism, 5600 Fishers Lane, Rockville, Md. 20852  
1975 ; 170p 581refs  
DHEW Pub. No. (ADM) 75-212  
Availability: GPO \$2.55. St. No. 017-024-00399

HS-016 541

# **SPECIFICATION AND SIMULATION OF PYROTECHNIC ENVIRONMENTS**

Explosive devices are commonly employed on aerospace vehicles to perform various structural separation functions. Practices are summarized which have evolved for specifying and performing tests to determine the functional and structural in-

laboratories by shaker/synthesizers; excitation of resonant fixtures by ordnance, hammer blows, or fracture of tensile links; drop testers; and others. The shaker test, single-pulse tests and rigid fixtures versus support structure are involved. Margins for testing depend upon the purpose of the test: i.e., development, qualification, or acceptance; upon the statistical validity of the source data; and, upon the physical capability of the test system.

by L. G. Smith  
Hughes Aircraft Co.  
Rept. No. SAE-740805 ; 1974 ; 6p 10refs  
Presented at National Engineering and Mfg. Meeting, San Diego, Calif., 1-3 Oct 1974  
Availability: SAE

HS-016 542

# **A LABORATORY FATIGUE TEST PROGRAM FOR STEERING COMPONENTS BASED ON FIELD LOAD DATA**

In 1971, General Motors Proving Ground embarked on an extensive program to better define steering system load conditions and the frequency of high loads under various forms of customer usage. Horizontal loads encountered by the steering gear pitman arm were monitored during general driving, rural mail carrier, taxi, insurance adjuster, and police operation. Development of a procedure for duplicating the field conditions at the Proving Ground and then running a total spectrum of loads in the laboratory at the frequency seen in the field became a realistic objective. To accomplish this it was necessary to be able to predict the field load curve of future car models, and thus build a data bank of part capability curves for various slopes and ranges that will encompass most conceivable future vehicle curves. Thus prior tests can be used to evaluate the durability of a component relative to a new vehicle application without the need for initiating a new test program.

by T. S. Chelsky  
General Motors Corp., Saginaw Steering Gear Div.  
Rept. No. SAE-740944 ; 1974 ; 8p 2refs  
Presented at Automobile Engineering Meeting, Toronto, Canada, 21-25 Oct 1974  
Availability: SAE

HS-016 543

# **A TECHNIQUE FOR THE VALIDATION OF VEHICLE MODELS USING THE ROAD SIMULATOR**

Ways are shown for using the road simulator to provide the engineer with a validated mathematical model which he can use to perform a parametric study to improve ride comfort. Specific areas of discussion are: mathematical model verification; correlation of model and simulator data; and parameter adjustment to obtain improved ride. As a result of this study the design engineer has a more precise vehicle model than has been available, and the test engineer has a verified laboratory simulation technique for vertical dynamic terrain inputs. The combined effect of these two engineering tools will serve to

HS-016 544

produce a better vehicle initially which will eliminate many of the initial field test failures.

by J. W. Grant  
United States Army Tank-Automotive Command  
Rept. No. SAE-740945 ; 1974 ; 8p  
Presented at Automobile Engineering Meeting, Toronto,  
Canada, 21-25 Oct 1974  
Availability: SAE

HS-016 544

### **PRESENT STATUS OF COLD-ROLLED HIGH STRENGTH STEEL DEVELOPMENT**

Interest in the use of high strength cold-rolled steel sheets is growing primarily because of the greater weight reduction that can be realized in automotive vehicles when the thinner gage, higher strength cold-rolled sheets are substituted for the heavier gage hot or cold-rolled sheets currently used. Today's steelmakers have considered and tried several metallurgical alternatives and philosophies which have resulted in the production and availability, either in commercial or developmental quantities, of formable, high-strength, cold-rolled steels with yield strengths in the range of 50 to 120 ksi. These steels have as good or better properties as the standard lower strength, cold-rolled steels. By varying the importance and effect of metallurgical efficiency, deoxidation philosophy, recrystallization behavior, hot band processing, and the cost of the alloying addition, steelmakers have developed and in several cases commercialized, new high strength or cold-rolled steels with high strength high formable steels.

by G. J. Klems; J. M. Gray  
MolyCorp, Inc.  
Rept. No. SAE-740958 ; 1974 ; 8p 15refs  
Presented at Automobile Engineering Meeting, Toronto,  
Canada, 21-25 Oct 1974  
Availability: SAE

HS-016 545

### **DESIGN AND TEST OF PICKUP TRUCK BOX COVER**

the problem of adding new assembly operations to already established assembly lines requires much planning and probably an expansion of facilities. New equipment must be installed and floor space increased to facilitate the new operation. Improvements made on an assembly line to facilitate the production of a new line of fiberglass truck campers are described.

by I. J. Leichte  
Rockwell International, Automotive Products Div.  
Rept. No. SAE-740978 ; 1974 ; 4p  
Presented at Automobile Engineering Meeting, Toronto,  
Canada, 21-25 Oct 1974  
Availability: SAE

HS-016 546

HSL 75-10

BAYFLEX parts in these applications are discussed. The results of the development of these types of urethane elastomers were demonstrated in 1974 with the production of flexible exterior body parts from BAYFLEX 100 SR at Krauss Maffei in Munich. The elastomeric materials allow freedom of design for bumper systems which absorb impact and provide complete recovery, thus avoiding petty or nuisance damages. This successful demonstration represents only a beginning for the large scale use of elastomeric exterior body components in automotive applications.

by H. Schaefer  
Bayer AG  
Rept. No. SAE-741023 ; 1974 ; 12p  
Presented at Automobile Engineering Meeting, Toronto,  
Canada, 21-25 Oct 1974  
Availability: SAE

HS-016 547

### **THE INFLUENCE OF WIND TUNNEL SOLID BOUNDARIES ON AUTOMOTIVE TEST DATA**

Wind tunnel tests were conducted on a series of 1/4-scale, 1/6-scale and 1/8-scale models of various automotive configurations utilizing a wind tunnel fitted with adjustable ceiling and sidewall inserts. Force, moment, and static pressure distribution data were acquired and used to develop corrections which appear to account for the constraints imposed on the flow field about these bodies by solid tunnel walls. Test section size limitations are defined for the acquisition of reliable data from automotive configurations.

by W. H. Bettes; K. B. Kelly  
California Inst. of Tech.; General Motors Corp.  
Rept. No. SAE-741031 ; 1974 ; 16p 2refs  
Presented at Automobile Engineering Meeting, Toronto,  
Canada, 21-25 Oct 1974  
Availability: SAE

HS-016 548

### **MEASUREMENT OF AUTOMOTIVE TIMING CHAIN DRIVE LOADS**

A system to measure loads that a timing chain is subjected to has been developed. The system consists of a special sprocket transducer and associated telemetry equipment. The conventional camshaft sprocket is replaced by the special sprocket transducer which senses the torque and transmits it by means of telemetry to recording equipment. The system made possible the investigation of parameters that affect timing chain life and resulted in an improved timing chain design.

by S. A. Avramidis  
FMC Corp., Chain Div.  
Rept. No. SAE-741046 ; 1974 ; 8p 2refs  
Presented at Automobile Engineering Meeting, Toronto,  
Canada, 21-25 Oct 1974  
Availability: SAE

HS-016 549

### A NEW INTERFACING CONCEPT: THE MONOLITHIC TEMPERATURE TRANSDUCER

A monolithic integrated circuit has been developed that is a sensor, a voltage reference, and an operational amplifier, all in a simple four-lead package. Although the circuit is designed to sense absolute temperature as a physical parameter, certain application techniques allow other inputs to be handled. Differential temperatures, position, and air velocity can be converted to analog, on-off, or frequency outputs as desired. Specific examples are provided.

by P. Lefferts  
National Semiconductor Corp.  
Rept. No. SAE-741075; 1974; 12p 3refs  
Presented at Automobile Engineering Meeting, Toronto,  
Canada, 21-5 Oct 1974  
Availability: SAE

HS-016 550

### DESIGN SOLUTIONS FOR TEMPERATURE SENSING IN DIFFICULT AUTOMOTIVE APPLICATIONS

Three different types of temperature measurement on the automobile and the development of suitable controls are discussed. High temperature probe controls are discussed. High temperature probe controls for emission catalysts; small, fast response thermostats for engine blocks; and PTC ceramic sensors for a variety of uses are developed.

by B. J. Misek  
Texas Instruments, Inc.  
Rept. No. SAE-741077; 1974; 8p  
Presented at Automobile Engineering Meeting, Toronto,  
Canada, 21-5 Oct 1974  
Availability: SAE

HS-016 551

### PAST AND CONTEMPORARY TRENDS OF COMMERCIAL VEHICLES IN JAPAN AS VIEWED BY FLEET OWNER

The development of motor truck transportation in Japan from its inception to the present day is discussed. Factors influencing the development of such transportation, including an initial lack of gasoline and the uses of substitutional fuels, the popularization of diesel engine trucks, the necessity to conserve fuel, geographic considerations, changes in the construction of trucks to lower costs and maximize efficiency, and the necessity for special purpose trucks, are detailed. Predictions of future trends and a consideration of ways in which motor transportation will be combined with other modes of transport are also discussed.

by H. Yanase  
Nippon Express Co., Ltd., Japan  
Rept. No. SAE-741125; 1974; 16p  
Presented at Truck Meeting, Troy, Mich., 4-7 Nov 1974  
Availability: SAE

HS-016 552

### DIESELIZATION OF LIGHT AND MEDIUM DUTY COMMERCIAL VEHICLES IN JAPAN

The recent trend toward dieselization of light and medium duty trucks in Japan is described. The customer needs are of prime consideration in engine development. Improvements have been made mainly in the areas of increased power, fuel economy, and anti-pollution. Maximum effort is being applied to meet government regulations both in exhaust emissions and noise. Some of the recent engineering developments in light duty, high speed diesel engines in Japan are examined.

by R. Kihara; T. Yamaguchi; Y. Mikami  
Isuzu Motors Ltd., Japan  
Rept. No. SAE-741126; 1974; 11p 2refs  
Presented at Truck Meeting, Troy, Mich., 4-7 Nov 1974  
Availability: SAE

HS-016 553

### THE ECONOMICAL DESIGN OF THE DATSUN PICKUP

The development of the Datsun pickup truck is traced from the post-World War 2 model with a wooden body, to the modified passenger car, to the current independent truck model. Some differences between the Datsun pickup and other Japanese-made trucks for export and American-made trucks are discussed. It is noted that the Japanese stress load efficiency and the Americans do not. Problems with size-dependent taxation rates, crowded roads, and scarce, expensive oil supplies have all led to a compact, economical design. The truck's adaptability to export destination requirements and its body construction are also discussed.

by F. Suzuki  
Nissan Motor Co., Ltd.  
Rept. No. SAE-741127; 1974; 10p  
Presented at Truck Meeting, Troy, Mich., 4-7 Nov 1974  
Availability: SAE

HS-016 554

### BRAKESAVER -- CATERPILLAR'S HIGHWAY TRUCK RETARDER

A hydrodynamic retarder for heavy duty highway trucks is described which was developed to fill the need for a high capacity silent truck retarder that is independent of truck ground speed. The retarder is mounted between the engine crankshaft and the flywheel to take advantage of the transmission speed multiplication. Engine oil is the working fluid and the engine cooling system is used to dissipate the heat of retardation. The retarder designed for the new Caterpillar 3400 series of heavy duty truck engines is discussed. Ratings that can be adjusted from 200 to 550 hp with minor hardware changes and unitized construction that can be adapted to many other engine configurations are the unique features of the design.

by C. T. Darragh  
Caterpillar Tractor Co.  
Rept. No. SAE-741129; 1974; 11p  
Presented at Truck Meeting, Troy, Mich. 4-7 Nov 1974  
Availability: SAE

HS-016 555

## ENGINE DESIGN FOR THE FUTURE

The demands of legislation, particularly as concerns noise and exhaust emissions, together with a greater emphasis on fuel economy as well as other economic factors will shape future engine design policy. Legislative and economic requirements will control future development of diesel power plants. Discussion of detailed engine design encompasses vehicle weight, power/weight ratio, exhaust smoke and odor, noise, crankshaft, valve gear, cylinder, etc. It is predicted that future designs will evolve from the best of current practice. Although severe exhaust emission legislation may favor indirect injection, the classic direct-injection system is likely to remain the popular choice in the future, mainly because of its better fuel economy and lower thermal loading.

by H. W. Barnes-Moss  
Ricardo and Co. Engrs. (1927), Ltd.  
Rept. No. SAE-741130 ; 1974 ; 18p 12refs  
Presented at Truck Meeting, Troy Mich., 4-7 Nov 1974  
Availability: SAE

HS-016 556

## CRITICAL ASSESSMENT OF SOCIAL AND ECONOMIC IMPLICATIONS OF SAFETY CARS

Some facets of the safety vehicle performance are examined with respect to broad social, political, and economic considerations. Aggressiveness is discussed in detail. Vehicles like the U.S. experimental safety vehicles (ESV) prototypes, which exceed the 4000-lb specification by 1000 lbs or more, might present a hazard to the other, lighter vehicles now on the road. The possible effects on fatality statistics and a mechanical analysis of aggressiveness are presented. A cost-effectiveness evaluation of the complete safety vehicle is discussed on the basis of an estimated dollar cost of automobile accidents, injuries, and fatalities. For comparison a similar evaluation of add-on safety features is made. The effects of loss of the U.S. automobile market on the economies of foreign auto exporting countries, should their small automobiles fail to meet stringent U.S. safety standards, are assessed. The added burden on energy resources by the introduction of heavy safety vehicles is also analyzed.

Columbia Univ., School of Engineering and Applied Science,  
New York City  
1974 ; 98p 36refs  
Availability: Corporate author

HS-016 557

## INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), LONDON, ENGLAND, JUNE 4-7, 1974

Opening remarks, status reports by governmental representatives from the United States, France, the Federal Republic of Germany, the United Kingdom, Italy, Sweden, and Japan, and their automotive industries are presented, along with the technical papers and seminar discussions. Topics covered include accident analysis, human factors, vehicle structural properties, accident avoidance, overall car requirements, and the application of research results to standards, production vehi-

cles, and future activities. Concluding remarks by the United Kingdom and United States are given.

National Hwy. Traffic Safety Administration, Office of Vehicle Safety Res., Washington, D. C.  
1975 ; 1002p refs  
Availability: GPO \$10.20 as Stock no. 050-003-00210

HS-016 558

## EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS. PT. 1. UNITED STATES

The American experimental safety vehicle (ESV) family sedan project is reviewed along with the status of the recently initiated Advanced State-of-the-Art Research Safety Vehicle (RSV) project. Problems with excessive weight and aggressiveness are described, and vehicle handling characteristics are reviewed. Areas demanding further research are identified with regard to the ESV. The RSV project takes special recognition of the projected transportation challenges of the 1980s, and is briefly mentioned.

by V. J. Esposito  
National Hwy. Traffic Safety Administration, Office of Vehicle Safety Res.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p11-4  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 559

## EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS. PT. 1. UNITED STATES [ESV TESTING]

Results of the most recent experimental safety vehicle (ESV) tests in the United States are discussed. Data from tests with Toyota and Nissan ESVs regarding accident avoidance in terms of brake tests, pedal force, and lateral accelerations are compared with Fiat tests. Vehicle performance was acceptable; results are given for vehicle response, dummy chest, pelvic and femur performance, and dummy head performance. Provision of additional vehicles for cooperative testing in the U.S. is advocated. It is felt that such international cooperation can help each country in synthesizing the research and engineering results from each individual project into significant and applicable knowledge.

by N. S. Stahler  
National Hwy. Traffic Safety Administration, Office of Vehicle Safety Res.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p15-9  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 560

## EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS.



## PT. 2. EUROPEAN EXPERIMENTAL VEHICLES COMMITTEE

The European Experimental Vehicles Committee is described and its objective defined as the coordination of the existing and proposed car safety technical activities of European participants in the international ESV program, including the problems of noise and exhaust pollution. The future for car safety in Europe is discussed. Accident research is identified as the basis for safety developments, and consideration is given to: representing accident impacts by test procedures; test procedures which should lead to the development of safer cars; accident avoidance; pedestrian protection; and occupant protection. The committee report provides important guidelines for improving car safety in the future.

by H. Taylor

Transport and Road Res. Lab., Dept. of the Environment;  
European Experimental Vehicles Com.

Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p21-3  
1975

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 561

## THE FUTURE FOR CAR SAFETY IN EUROPE. A REPORT OF THE EEVC

Guidelines for improving car safety in the future are presented, most of which do not require sophisticated engineering designs for cars and should not be unacceptably costly or impose much weight penalty. The role of the European Experimental Vehicles Committee (EEVC) for car safety in Europe is outlined, and the study of accidents is identified as the basis for safety developments. Consideration is given to: representing accident impacts by test procedures; accident avoidance; pedestrian protection; occupant protection; and outlook for the future. The working groups and their tasks are mentioned. A review of data sources for car safety improvements includes a review of the use made of accident data in Europe. This includes the magnitude of any given safety problem, the identification of high risk situations, the prediction and ranking of safety measures, evaluation of existing safety measures, and methods for assessing driver performance, attitudes, and human injury tolerance. Future needs for data sources on car safety improvements are explored, and recommendations made. The order of priority and major requirements for safer cars for the near future is given, covering occupant protection measures in various accident types, and the protection of pedestrians and exposed riders. Human tolerance levels and occupant protection evaluation techniques are investigated and recommendations made.

European Experimental Vehicles Com.

Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p24-54  
1975

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 562

## BASIC RESEARCH VEHICLE-RENAULT BRV

An analytical method for defining and resolving the problems associated with occupant protection is presented. Technical collaboration in research work has allowed knowledge to be furthered in an important and non-selective way. The most critical problem remains the industrial developing of occupant restraining devices which are valid for and usable by all automobile users; biomechanical research is needed. The controlled strength of the front and rear parts of structures can pass to the industrial stage. Side collision protection remains the most difficult problem, and an improvement of pedestrian protection up to collision speeds is needed. The importance of the economic weight of decisions modifying the automobile makes thorough, systematic and international studies indispensable. Photographs and tables show results of impact tests and actual collisions. Cost effectiveness of several combinations of restraints is tabulated in terms of injuries and deaths avoided. Side collisions, rollovers, rear collisions, and pedestrian protection are treated in detail.

by P. Ventre

Renault State-Owned Works

Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5th), Washington, D.C., 1975 p60-82  
1975 ; 16refs

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Availability: In HS-016 557

HS-016 563

## [CITROEN EXPERIMENTAL SAFETY VEHICLE PROGRAM]

The Citroen experimental safety vehicle program (ESV) is reviewed which focuses on the study of subassemblies and partial structures of a 1500 lb vehicle and the restraint systems which may be fitted to it. Occupant protection factors considered include the physiopathological effects due to deceleration, impacts and occupant stoppage and restraint loads, and movements resulting from vehicle stop during impact. The unity of the man-seat-restraint structure is described, and protection criteria are identified for the head, thorax, abdomen, pelvis, and femur. Tests show that submarining, particularly important for a 5th percentile adult female, could be suppressed by a practically vertical position of the restraint pelvic element.

by M. Clavel

Anonymous Society of Citroen Automobiles

Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p83-102  
1975

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HS-016 564

## OPEL'S SAFETY DEVELOPMENT PROGRESS REPORT

The Opel Safety Vehicle (OSV 40) is described, an experimental safety vehicle designed for 40 mph barrier impact speeds

Specifications are given for the front wheel suspension, rear wheel suspension, brakes, steering, wheels and tires, and engine. Its operational safety is reviewed along with pedestrian safety, occupant protection, head, chest and pelvis injury criteria, and crash test results. It is concluded that this research vehicle will permit Opel to check the effectiveness of the incorporated safety systems and their possible future use for production based on realistic cost-benefit analysis.

by F. Lohr

Adam Opel AG

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p108-19 1975

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 565

### THE ESVW 2, VOLKSWAGEN'S EXPERIMENTAL SAFETY VEHICLE

The ESVW 2 is an experimental safety vehicle based on a production car of a lower weight class, which has always been the emphasis of the VW model program. The requirements in active and passive safety, fulfilled by the ESVW 2, exceed all valid specifications for production cars. The ESVW 2 is approximately 15% heavier than the standard car from which it was developed and its more elaborate design and equipment would result in about a 30% increase in cost. The fuel consumption would increase about 15% due to the additional weight. Production of the ESVW 2 is not expected although some safety features which can be produced at realistic costs have already been incorporated in current production cars or are available as optional equipment. Vehicle design specifications are given, and restraint systems are discussed with results of frontal impacts against barriers and poles, side impacts, rear end impacts, and frontal impacts against a heavy car. Injury criteria, severity indices, and maximum acceleration are tabulated for the head and chest, and maximum load for the femur in frontal impacts against a fixed barrier at 40 mph, and in frontal impacts with a pole at 30 mph. Vehicle handling and stability specifications and results are covered, and safety features of the ESVW 2 are shown.

by W. Lincke

Volkswagenwerk AG, Res. and Devel. Center

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p120-32 1975

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HS-016 566

### BRITISH LEYLAND/TRRL EXPERIMENTAL SAFETY SYSTEMS CONTRACT

Work on the entire contract was divided into three separate development periods: Standard Vehicle, involving an agreed series of impact tests on production vehicles, to establish the degree of modification necessary to meet performance targets; Phase 1, covering the design, manufacture and testing of

mitigate the severity of pedestrian impacts. Details are given on: energy absorbing bumpers, standard vehicle safety impacts and development design, side impacts on two and four-door models, seat belt design, restraint systems, head and shoulder impacts, knee and leg impacts, rib, pelvic and leg impacts, steering columns, and general specifications.

by P. M. Finch

British Leyland Motor Corp., Ltd., Safety Test and Devel. Dept.

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p137-77 1975

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HS-016 567

### [THE SAFETY VEHICLE PROGRAM AT BRITISH LEYLAND MOTOR CORPORATION]

Themes and strategies depicted in a film presentation on the TRRL-British Leyland program for vehicle safety at realistic costs are reviewed, and progress during the first year of the 2 1/4 year contract is covered. The contract requirements are for improvements in accident avoidance, occupant protection and vehicle-to-vehicle compatibility, and pedestrian protection. The program requires that specimens of each of the vehicle types be submitted to controlled dynamic testing in each of the major crash modes, full frontal impact, front offset impact, and rollover, supplementing this work where necessary with both static crush and computer simulations.

by W. J. Daniels

British Leyland Motor Corp., Ltd., Austin Morris Vehicle Safety Res. Proj. Section

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 P178-212

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HS-016 568

### OCCUPANT PROTECTION IN FRONTAL IMPACT (PASSIVE RESTRAINT), REAR IMPACT AND ROLLOVER

Ford's contract with the United Kingdom for certain safety features is reviewed. Three separate projects are included, covering rollover, passive restraint, and rear impact. Rear impact protection is largely a problem of vehicle structural design and the control of vehicle deformation during impact. The passive restraint project is an exercise in occupant protection in which the vehicle interior and its restraint systems are the key, and it does not include any attempt to influence the vehicle structural design. The rollover project has elements of both structural design and interior protection, coupled with the

difficulty of correlating much more complicated vehicle dynamics with a standardized test format.

by M. Rodger  
Ford Motor Co., Ltd., Res. and Engineering Center  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p213-7  
1975

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Availability: In HS-016 557

HS-016 569

### **EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS. PT. 6. ITALY**

The Italian commitment to experimental safety vehicles is reviewed and certain projects are described. They include: a study on the audibility of sound signalling inside the passenger compartment of speeding vehicles and the formulation of regulations for sound signalling of high sound power; a study on low-frequency components present in the noise spectrum made at the vehicle exhaust; a study of sound directionality and the formulation of regulations for supplementary alarm sound signalling, to be mounted on vehicles on emergency services; a study on sound penetration inside the crash helmets of motorcyclists; studies on the testing procedure for determining emissions of carbon monoxide in low gear, formulation of requirements for approval of carbon monoxide analyzers and opacimeters of diesel motor exhausts, and the relationship between studies for the experimental safety vehicle and research safety vehicle programs.

by A. Sigrignano  
Ministry of Transport and Civil Aviation, Italy  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p219-22  
1975

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HS-016 570

### **FIAT TECHNICAL PRESENTATION**

Fiat research emphasizing compatibility and restraint systems is reviewed with illustrations of testing. Details are given on frontal collisions between three Fiat ESV models, side collisions, sideswipe, pedestrian collision, conventional belts, in-line friction dissipator belts, in-line deformation dissipator belts, retractor-incorporated friction dissipator belts, retractor-incorporated deformation dissipator belts, dissipator/pre-loader belts, swinging-arm supporting device, mobile cross-member supporting devices, and collapsible or retractable steering wheel. The test results demonstrate the unacceptability of weight and cost increases in small and medium-small cars.

by V. Montanari  
Department of Motor Cars  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p223-43  
1975

Conference held in London, 4-7 Jun 1974.

HS-016 571

### **STEERABILITY DURING EMERGENCY BRAKING. SWEDISH ESV PROJECT**

Steerability during emergency braking is discussed, including safety benefits, test procedures, and performance standards regarding stability, steerability, and brakeability. Field test and simulation results indicate that, for stability, maximum vehicle side slip angle should not exceed 20°; the steerability and brakeability should be taken into consideration at the same time; and the performance should be within the recommended area for vehicles in the 1000-1500 kg (2200-3300 lb) class.

by S. Rundkvist  
Swedish ESV Project  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p246-9

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HS-016 572

### **THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (GENERAL DESCRIPTION)**

Accident avoidance performance tests and collision and rollover tests of the Japanese experimental safety vehicles (ESVs) are reviewed. Details are given on test methods and test equipment, overturning, automatic driving system for J-turn tests, data recording and data reduction system, bumper underride/override measuring system, crash test facilities, and tow system. Emphasis was on the pursuit of the optimum technical possibilities.

by Y. Okami  
Japan Automobile Res. Inst., Inc. (JARI)  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p253-71  
1975

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HS-016 573

### **THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (SUMMARY OF TOYOTA ESV TEST)**

Results of 738 accident avoidance tests and six rollover tests are reviewed. Consideration is given to field of view, display and controls, braking performance, steering, handling, overturning immunity, engine performance, bumper under-ride/override, and collision and rollover test conditions. Test results are tabulated for brakes, yaw response, returnability, lateral acceleration, steering, handling, and bumper under-ride/override. Dummy head and chest accelerations, and femur loads are tabulated for an 80 km/h flat barrier impact, an 80 km/h pole impact, a 25 km/h pole side impact, an 80 km/h rear

end impact, and rollover. Vehicle structural response to these tests is also tabulated.

by Y. Okami  
Japan Automobile Res. Inst., Inc. (JARI)  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p275-300  
1975  
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HS-016 574

### THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (SUMMARY OF NISSAN ESV TEST)

The Nissan ESVs have been developed with special emphasis placed on creation of vehicles with significant overall safety features in everyday traffic. The four-door family sedan was selected. Specifications and distinctive features are outlined. Accident avoidance tests totalling 810, and six rollover tests were conducted, concentrating on field of view, display and controls, braking, steering (including yaw response and returnability), handling (including lateral acceleration, control at breakaway, crosswind, pavement irregularity, and steering control sensitivity, overturning immunity, and bumper under-ride/override), and collision and rollover test conditions. Dummy head and chest accelerations and femur loads are tabulated for 80 km/h flat barrier impact, 65 km/h rear end impact, 25km/h pole side impact, and rollover. Vehicle structural response for these tests is also given.

by Y. Okami  
Japan Automobile Res. Inst., Inc. (JARI)  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p301-25  
1975  
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HS-016 575

### TRAFFIC ACCIDENTS IN JAPAN

The increase in the trend of motor vehicles in use in Japan is reviewed along with the number of licensed drivers, and the length of paved roads from 1954 to 1973. Rapid progress in motorization is indicated which has brought about unfavorable effects on the human environment, such as traffic accidents, traffic congestion, and traffic hazards of various types. General conditions of traffic accidents are presented, as well as an analysis of traffic accidents, with emphasis on fatal accidents. Half of the recorded total deaths are pedestrians and bicyclists. Driver characteristics, accident causes, road environment, traffic safety facilities, signals, speed, seat belt needs, injuries by body area are discussed, and pedestrian fatalities.

by M. Nagakuna  
National Police Agency, Traffic Bureau  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p338-47  
1975  
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HS-016 576

### A PROPOSED NEW NATIONAL SYSTEM FOR COLLECTING MULTIPURPOSE ACCIDENT DATA: SIR

A national system of data collection to provide information suited to the multiple needs of government and industry is discussed. The problems with and uses of present data are explored as background. Three coordinate kinds of data collection programs are recommended: a Sampling program, to collect data for an accurate and sensitive model of national phenomena; an In-depth program, to collect multidisciplinary data useful for identifying new problems; and a Rapid-response study program to collect data needed for answering pressing questions. Each would be performed by small groups of professional accident investigators operating in carefully defined geographic regions. Federal information systems comparable to the SIR program are described.

by J. O'Day  
University of Michigan, Hwy. Safety Res. Inst.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH) Washington, D.C., 1975 p349-61  
1975  
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HS-016 577

### EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE, CAR WEIGHT AND CRASH INJURIES IN CAR-TO- CAR CRASHES

Relationships between car size, car weight, and severity of occupant crash injuries in car-to-car crashes are developed using a simple mathematical model to analyze real-world crash data. For vehicles using the same roads, these relationships suggest a crashworthiness design concept for intervehicular crashes that regards increases in vehicle size as primarily protective, and increases in vehicle weight as primarily hostile, indicating the desirability of relatively sizeable but not heavy vehicles.

by B. O'Neill; H. Joksch; W. Haddon, Jr.  
Insurance Inst. for Hwy. Safety; Center for the Environment  
and Man, Inc.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p362-8  
1975 ; 13refs  
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HS-016 578

### FACTORS INFLUENCING THE PERFORMANCE OF THE ENERGY ABSORBING STEERING COLUMN IN ACCIDENTS

Maximum compression of the energy absorbing device (EAD) occurs when forces are applied in a plane perpendicular to the steering column. The angle of force application is influenced by many factors, including the frontal area of the car impacted, the direction of force, vehicle rotation, accident severity, and driver approach angle. Generally, as the angle of

sembly upon impact also appears to influence the compression of the column. Any vertical component of force in a frontal impact was found to be particularly useful in predicting column behavior. A review of compliance test procedures should be considered in view of the fact that, even in frontal impacts from 11 to 1 o'clock where at least one occupant required hospital treatment, approximately 76% of the columns studied compressed one inch or less. Photographs and diagrams illustrate accident case histories showing EAD performance in relation to area of impact and impact severity, vehicle rotation, direction of force, and height of impact. A statistical summary of case data relates vehicle crush and EAD compression; vehicle crush, EAD compression, and car make; vehicle crush, EAD compression, and restraint use; vehicle crush, EAD compression, and driver injury; and restraint use and injury. Results of this study should not be interpreted as arguments against the EAD, but as indications of the need for improved design.

by J. W. Garrett; D. L. Hendricks  
Calspan Corp.

Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p369-94  
1975 ; 17refs

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HS-016 579

#### **NHTSA'S EVALUATION OF AIR CUSHION RESTRAINT SYSTEM EFFECTIVENESS (ACRS)**

Objectives of the evaluation program are: to assess the injury-reducing effect of air cushion restraint systems (ACRS); to determine operational characteristics of the ACRS; and to evaluate public/owner acceptance. Sampling methods for comparison of ACRS injury data with control injury data are discussed and the weaknesses and strengths of several methods explained. The performance of the ACRS is explored in relation to the types of crashes which deploy the ACRS, the types of injuries which result from its deployment, and its tendency to deploy inadvertently. Owner survey is expected to be the method used to determine public reaction to the ACRS. An improved sampling plan useful in the analysis of ACRS data is explained, and data collection methods are commented on.

by D. F. Mela  
National Hwy. Traffic Safety Administration, Office of  
Statistics and Analysis

Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p395-403  
1975 ; 4refs

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HS-016 580

#### **SYNTHESIS OF STATISTICAL DATA ON TRAFFIC ACCIDENTS IN FRANCE, WEST GERMANY, ITALY AND UNITED KINGDOM**

Accidents were described in each country as to road user category, type of obstacle, injury severity, and direction and severity of impact. The proportion of pedestrian, cyclist and motorcyclist victims of fatal accidents is currently over 50% of the killed total. It is expected that measures reducing accident

severity for the occupants, such as speed limits, fixed obstacles protection, and passive safety measures, will increase the relative number of people killed outside cars. Car aggressivity must be reduced to protect pedestrians; lateral impact studies need to be improved as well as truck overhanging structures. A uniform method of compiling and reporting statistics would be useful to achieve worldwide cooperation in accident studies.

by F. Hartemann; C. Tarriere  
Association Peugeot-Renault, Biomechanic-Accidentology and  
Crashworthiness Groups (C.M.C.)  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p405-13  
1975 ; 12refs

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HS-016 581

#### **THE ROAD SAFETY CHECKLIST--A PERIODICAL INQUIRY REGARDING TRAFFIC**

The purpose of this inquiry is to gather qualitative and quantitative information as to the behavior of drivers, so as to relate it to the characteristics of those involved in deaths and bodily injuries and thus to appraise the criteria of exposure to risk. This method of comparison is illustrated by assessment of the effectiveness to seat belts. It was found that in 1972, in the absence of a regulation requiring seat belt use, and of any general speed limit, the risk of being involved in a death or injury was greater if the person used his seat belt than if he did not; but that since use of the belt has been made mandatory, the risk has been reduced by nearly two-thirds. This relative risk is now approximately 0.6. This is attributable to the fact that use of a seat belt is reflected in an initial phase (optional use), from the behavioral standpoint, in an assumption of risk which may exceed the norm, and is reflected in a second phase (mandatory use) in a conversion of involvement in death or injury into involvement in property damage. As these two factors have contrary effects, it is normal to observe such a variation in the rate of risk over two years. Taking this rate of risk into account in the calculation of effectiveness, and with reference to country roads, an estimate results of the combined effectiveness of the speed limit and of the use of seat belts, 63% for deaths, 36% for injuries, and 38% overall.

by J. C. Bluet  
Organisme National de la Securite Routiere, ONSER, France  
Publ: HS-016 577, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p414-20  
1975

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HS-016 582

#### **THE FREQUENCY OF CORRESPONDING VEHICLE DAMAGE IN CRASH TESTS AND ACTUAL ACCIDENTS**

On the basis of 813 actual accident involving 1626 damaged vehicles studied by the German HUK-Verband, a frequency categorization of types of damage is set out, and the question examined as to what proportion of all car accidents involving injuries to occupants is reflected by present-day crash tests

Details are given on: frequency allocation of types of damage in car/motor vehicle accidents; frequency of damage in all car accidents with injuries to occupants; and relative proportion of ESV crash tests to actual types of damage. By means of present ESV Crash Tests, some 20-25% of actual accidents with injuries to occupants can be reproduced. This percentage results from the frequency of head-on tests against fixed barriers and poles, and rear-end impacts against moving barriers. Damage categories which occur most frequently in actual accidents, i.e. angle front end collisions with overlapping (offset frontal impacts) are not taken into account in the ESV crash test program.

by M. Danner; K. Langwieder  
German Assoc. of Liability, Accident and Motor Traffic Insurer-(HUK-Verband)  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p421-6 1975 ; 10refs  
Conference held in London, 4-7 Jun 1974.  
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HS-016 583

### **ACCIDENT INVESTIGATION AS AN AID TO PLANNING THE FUTURE OF CAR SAFETY**

Some of the accident investigation techniques used in Great Britain for safety planning are outlined, together with illustrative examples of the effects of possible safety measures and establishment of priorities in car safety. Statistical analyses are reported as well as in-depth investigations. Estimation of the effects of possible safety measures deals with protecting occupants of cars struck in the rear and accidents resulting from tires at reduced pressures.

by B. E. Sabey; I. D. Neilson  
Transport and Road Res. Lab., England  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p 427-32 1975  
Conference held in London, 4-7 Jun 1974.  
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HS-016 584

### **SOME PATTERNS AND CAUSES OF INJURY IN CAR OCCUPANTS**

An analysis is made of the patterns of injury among 768 unbelted and 111 belted occupants of cars involved in accidents which resulted in at least one person being detained in a hospital. The causes of severe and fatal injury received by the occupants are described for the different angles of vehicle impact, for the different seating positions, and for the different areas of the body injured. The chances of sustaining injury are compared for the unbelted and belted front seat occupants in the sample both for the body as a whole and for the different

parts of the body. Injury and fatality causes are tabulated by body area and accident type.

by E. Grattan; J. A. Hobbs  
Transport and Road Res. Lab., Dept. of the Environment, England  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p433-40 1975  
Conference held in London, 4-7 Jun 1974.  
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HS-016 585

### **NHTSA PROGRAMS IN BIOMECHANICS**

The NHTSA Biomechanical Studies Group has under contract or in negotiation more than 32 separate projects directly bearing on the area of human tolerance, human simulation, and protection systems. It is expected that valid injury criteria for all significant body areas, specifications for a valid, reliable family of anthropomorphic dummies, computer tools for assistance in the design and evaluation of advanced protection concepts, and computer programs for standards compliance testing will be provided.

by A. E. Hirsch  
National Hwy. Traffic Safety Administration, Office of Vehicle Safety Res.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, 1975 p443-5 1975 ; 23refs  
Conference held in London, 4-7 Jun 1974.  
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HS-016 586

### **GM-ATD 502 ANTHROPOMORPHIC DUMMY--DEVELOPMENT AND EVALUATION**

A new anthropomorphic test dummy system, GM-ADT 502, is described with its most important features illustrated. It is assessed regarding repeatability, reproducibility, ease of use and maintenance, and biofidelity. The program has also identified improved system and component test procedures and instrumentation for dummy development and evaluation. Since the performance goal of the program differed from the requirements of Regulation 572, the dummy does not meet those requirements. Recommendations are offered for biomechanics, anthropometrics, and test dummy hardware.

by J. A. Tennant; R. H. Jensen; R. A. Potter  
General Motors Engineering Staff, Advance Product Engineering  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p446-62 1975 ; 11refs  
Conference held in London, 4-7 Jun 1974.  
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HS-016 587

# **RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 1-- PROGRAM DEVELOPMENT**

The GM completely passive air cushion restraint system for front seat passengers is described along with the initial human volunteer test program, and the initial program to evaluate the effect of air cushion deployment on children. The production design program is outlined, and further consideration is given to: additional human volunteer test programs; program to predict restraint system effectiveness; field trial program; crash testing program; responses to proposed Federal safety standards; field accident data collection; and continuing programs.

by L. C. Lundstrom  
General Motors Corp., Environmental Activities Staff  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p463-7  
1975  
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HS-016 588

# **RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2--CRASH TESTING THE GENERAL MOTORS AIR CUSHION**

The introduction of a complex safety system such as the air cushion restraint system (ACRS) requires much more testing and evaluation than simply meeting FMVSS 208. Sled tests studied the following variables: environmental conditions, occupant size and position mix, failure mode, and final qualification. Crash program development includes impact configuration environment (field accident configuration comparison, sensor performance, and injury criteria), mileage and environmental effects, and occupant size and position mix. Crash tests were of the following types: 30 mph rear moving barrier, 60 mph car to parked car (front to front), 30 mph car to 14 inches diameter pole, 30 mph frontal barrier with bumper underderride, 30 mph lateral dolly rollover, two car moving 90° intersection collision, 30 mph two car 30° side angle impact, 40 mph frontal impact, chain reaction impact, 40 mph two car 45° left side angle impact, and 30 mph frontal impact. For occupant size and position mix, 30 mph frontal impact tests were conducted with: two lap belted dummies; a 95th percentile male driver dummy, a three year old male center front passenger dummy, seated, and a 5th percentile female right front passenger dummy; two unbelted dummies; and a 5th percentile female driver dummy and a 95th percentile male right front passenger dummy. Test are represented in diagrams and results are tabulated.

by R. A. Wilson  
General Motors Corp., Environmental Activities Staff  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p468-90  
1975  
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HS-016 589

# **RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 3--HUMAN VOLUNTEER TESTING**

Test procedures and observations are described on the human kinematic and physical response to impacts approximately equivalent to a 30 mph (48 kph) barrier crash. Comparisons are made between the volunteers and the dummies (Hybrid 2 50th percentile and 95th percentile) with tabulations of comparisons of head injury criteria and thorax severity indices, and dummy femur loads. The test environment is discussed along with instrumentation, volunteer preparations, and the tests. No significant injury was produced, and the backup restraint systems were not needed. The tests, however, depict an ideal situation, being conducted under the most safe and controlled conditions possible.

by G. R. Smith  
General Motors Corp., Environmental Activities Staff  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p491-9  
1975  
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HS-016 590

# **HUMAN INJURY TOLERANCE LEVEL DETERMINATION FROM ACCIDENT DATA USING THE OPAT DUMMY**

A technique is described for determining injury tolerance levels of motor vehicle occupants restrained by seat belts. Detailed accident injury data from accidents involving seat belt wearers are correlated with results of tests using the Occupant Protection Assessment Test (OPAT) dummy. Human injury tolerance levels are proposed for several parts of the body. These levels are applicable to readings from tests made using the OPAT dummy.

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Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p501-7  
1975 ; 7refs  
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HS-016 591

# **PEDESTRIAN PROTECTION**

Problems and possible solutions related to pedestrian protection are discussed. Victim, vehicle, exterior design, and speed factors are considered, and experimental collisions are described. Design changes are suggested including reducing the height of the bumper to no more than 40 cm., enlarging and covering with shock absorbing material the bumper surface in contact with the leg, designing the hood, headlamps, and fenders so that their shape and rigidity are as little aggressive as possible, using laminated glass in the windshield and masking its lower crossmember by the hood, and designing the windshield so that it is less likely to be hit. A variable geometry design for the front section of a vehicle which is in-

tended to modify pedestrian kinematics and to retain the pedestrian on the vehicle in order to lessen injuries, is illustrated and briefly discussed.

by C. Tarriere; G. Sclerbatcheff; P. Duclos; A. Fayon  
Association Peugeot-Renault, Laboratoire de Physiologie et de Biomecanique, France  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p508-10  
1975 ; 7refs

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HS-016 592

## BIOMECHANICAL STUDY OF SIDE IMPACT ACCIDENTS

It is shown that in-the-field side impact accidents generally occur involving important deformations of the passenger compartment. These deformations are often greater than those created by crash tests conducted with two moving vehicles, the speed of each one being 40 kph. The severity of injuries is a little higher for occupants seated on the side of the impact than for the others. This severity increases with the deformations of the passenger compartment. The crash tests give acceleration values of the dummy which are higher when the intrusion reaches the dummy during the impact. It is not possible to foresee the effect of stiffened structures on the passenger because the human tolerance to side impact is still little-known.

by D. Cesari; M. Ramet  
Organisme National de Securite Routiere, France  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p511-20  
1975 ; 7refs

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Availability: HS-016 557

HS-016 593

## THE DEVELOPMENT OF THE OPAT DUMMY

The coefficients of variation for the dummy developed as part of a United Kingdom program on vehicle occupant safety have been calculated and are compared with Hybrid 2 dummies tested at Calspan. It is noted that the larger variability on the chest results of the Occupant Protection Assessment Test (OPAT) dummy can be attributed to noise generated by the sternum striking the thoracic spine. This area has been redesigned to eliminate this noise. In the United Kingdom, the ESV program has shown a need for a fully specified, repeatable, robust and humanlike test dummy. Development to date has proved that it is possible to attain practical standards of humanlike performance combined with relative simplicity, robustness and economy of manufacture.

by P. Warner  
David Ogle Ltd., England  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p521-5  
1975

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HS-016 594

## PERFORMANCE MEASUREMENTS ON THE OPAT DUMMY

The Occupant Protection Assessment Test (OPAT) dummy is described with regard to component tests of head response, neck response, chest response, and abdomen response. The simulation of human data is discussed, with attention directed toward dynamic performance in sled tests. Performance measurements of the OPAT dummy head, neck, thorax, and abdomen showed that these were within the specification produced by the Transport and Road Research Laboratory. This, however, differs from NHTSA's July 1972 specification as well as FMVSS 208 Part 572. The head of the OPAT complies with all three specifications. It achieves a very close simulation of available cadaver data on chest response, and consequently deflects more than the Part 572 specification allows. Regarding repeatability of measurements, a compliance test device giving a scatter of about 5% appears acceptable. The scatter in head injury measures for the OPAT is 5% to 7.5%, but the coefficient of variation for the chest severity index is about 19%.

by C. M. Haslegrave; M. A. Macaulay  
Motor Industry Res. Assoc.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p526-32  
1975

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Availability: In HS-016 557

HS-016 595

## TOWARDS PEDESTRIAN SAFETY

The influence of changes in the front-end design of cars on the trajectories of adult and child pedestrians is demonstrated. No drastic changes are needed to pick up an adult on the hood of a front-engined car, but if the young child pedestrian is not simply to be knocked down by the car, more radical changes are needed. One way of retaining the pedestrian on the hood is shown. It is possible that redesign of the pedestrian catcher device may enable both adult and child to be picked up and retained on the hood without radical changes in the front-end configuration.

by V. J. Jehu  
Transport and Road Res. Lab., Dept. of the Environment, England  
Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p533-4  
1975 ; 1ref

Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 596

## A REVIEW OF DEVELOPMENT OF PASSIVE RESTRAINT SYSTEMS

It is established that improvements in the occupant protection capability of seat belt systems can be made, mainly by selection of webbing and use of load limiters in the belt layout. Further improvements, including an increase in the impact speed at which such systems are effective, can be made, in-



cluding the use of crash activated belt tensioning devices. Vehicle installations of three different systems of passive seat belts have been completed for longer term user evaluation. Impact testing with sleds, body shells, and vehicles are summarized. Passive seat belt systems that have been tested are: diagonal seat belt and knee restraint system; motorized centrally mounted lifting arm system; and the cord actuated system. A computer simulation of dummy kinematics is described, and subjective effects on occupants, such as hearing damage due to air bag deployment and loads imposed by belt tensioners, are noted.

Auto Restraints Systems, Ltd., England  
 Publ: HS-016 557, INTERNATIONAL TECHNICAL  
 CONFERENCE ON EXPERIMENTAL SAFETY  
 VEHICLES (5TH), Washington, D.C., 1975 p535-43  
 1975

Conference held in London, 4-7 Jun 1974.  
 Availability: In HS-016 557

HS-016 597

### **REDUCED LACERATION FROM A NEW LAMINATED WINDSHIELD**

The new windshield, Triplex Ten Twenty, is described which promised a substantial reduction in facial laceration without adverse consequences in other respects. Of laminated construction, it uses two pieces of 2.3mm thick float glass, which are thermally stressed to different levels, and a standard HPR polyvinyl butyral interlayer 0.76mm thick. Test programs have been carried out at Triplex using a dropping head form and a skull impactor sled, and by Wayne State University using a 50th percentile anthropomorphic dummy on their Wham crash simulator. The results are given in terms of Head Injury Criterion, Gadd Index and various laceration scales including a newly developed objective scale, the Triplex Laceration Index, based on the number and the measured length and depth of cuts in the dummy head coverings.

by J. Pickard  
 Triplex Safety Glass Co., Ltd., England  
 Publ: HS-016 557, INTERNATIONAL TECHNICAL  
 CONFERENCE ON EXPERIMENTAL SAFETY  
 VEHICLES (5TH), Washington, D.C., 1975 p544-51  
 1975 ; 2refs

Conference held in London, 4-7 Jun 1974.  
 Availability: In HS-016 557

HS-016 598

### **EVALUATION OF SEAT BELT SYSTEM AND DUMMY CHARACTERISTICS**

The effectiveness of seat belts is recognized, the problems involved in their usage are discussed, and the restraint capability of seat belts is examined through experience with the Nissan ESV E-2 development. Details are given on: effectiveness of reduction in belt slack; protection of occupant from secondary collision with steering wheel and column; force limiting and energy absorbing belt; position of anchor points for seat belts; knee protection; vehicle crashworthiness; influence of dummy characteristics and their variation including neck flexion and

head motion, mathematical simulation models; and differences between test and actual collision data.

by Y. Serizawa  
 Nissan Motor Co., Inc., Japan  
 Publ: HS-016 557, INTERNATIONAL TECHNICAL  
 CONFERENCE ON EXPERIMENTAL SAFETY  
 VEHICLES (5TH), Washington, D.C., 1975 p553-65  
 1975 ; 21refs  
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HS-016 599

### **RSV, CRASH HAZARDS AND PUBLIC SUPPORT**

Small cars, fuel system crashworthiness, and low-speed crashworthiness are examined. It is concluded that if the public at large is encouraged, by exposure to public and private research that exposes vehicle crash causation and crashworthiness deficiencies, to adopt high expectations and demands for Research Safety Vehicle program payoff, the program will stand a much greater chance of sustained public support for necessary funding and resources, and a much greater chance of active public demand for translating RSV results into real-world motor vehicle standards making and design decisions. Appendices include reports on crash data publicity, dangers of small cars in incompatible vehicle mixes, postcrash fire hazards, NHTSA's new fuel system rule, damage proneness of 1974 model cars, and restraint development in relation to rumelaking.

by A. B. Kelley  
 Insurance Inst. for Hwy. Safety  
 Publ: HS-016 557, INTERNATIONAL TECHNICAL  
 CONFERENCE ON EXPERIMENTAL SAFETY  
 VEHICLES (5TH), Washington, D.C., 1975 p573-601  
 1975 ; 5refs  
 Conference held in London, 4-7 Jun 1974.  
 Availability: In HS-016 557

HS-016 600

### **FRONT ENERGY MANAGEMENT PARAMETRIC VARIATION STUDY**

Analytical investigations of nine front energy management systems were conducted to evaluate their performance in terms of the protection provided a restrained occupant, aggressiveness in frontal impacts with conventional cars, and the crush distance required by each system. Two classes of energy management were considered, hybrid hydraulic/structural systems with velocity sensitive force deflection characteristics providing a near square acceleration pulse shape, and fixed force ramped systems with force deflection characteristics providing a relatively long ramp to a fixed force level. Each system was designed for a 4,700 lb. vehicle impacting: frontally, a rigid pole at 40 mph; a rigid barrier, frontally, at various oblique angles and speeds up to 45 mph; and frontally, another car whose acceleration was limited to 40 g's. The restraint system considered was a 10 cu.ft. air bag for the right front occupant. Bag characteristics were selected to suit the pulse associated with each energy management system, and the occupant response was determined for each system in 30 and 45 mph frontal impacts. Bag deployment times were 30 milliseconds and 40 milliseconds. The relative aggressiveness of the systems was analyzed by simulating impacts with conventional vehicles ranging in weight from 1,875 to 3,900 lbs. A

preferred hybrid system was selected after evaluating the analytical results. This system, having a 14 in. buffer stroke, an average acceleration of 27.7 g's and peak of 32.6 g's, was built and tested as a complete system. The test series, reflecting the range of impact conditions specified, verified, in most instances, the predicted behavior of the preferred system. The test program demonstrated that the selected system is capable of protecting the passenger from excessive acceleration and compartment intrusion in all baseline impacts with the possible exception of the off-center pole impact. In this case, the structure was forced to one side by the pole and was not fully effective in retarding the vehicle.

by W. Rupp

AMF, Inc., Advanced Systems Lab.

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p602-14 1975

Conference held in London, 4-7 Jun 1974.

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HS-016 601

## ANALYSIS OF TEST RESULTS FOR AMF/FIAT ESV HEAD-ON COLLISION

As part of its experimental safety vehicle (ESV) evaluation effort, Dynamic Science has recently conducted vehicle to vehicle aggressive testing of the large AMF ESV with two small Fiat ESVs (Fiat 2,000 lb. and Fiat 2,500 lb. classes) at a closure speed of 75 mph. Preliminary analyses of crash test results are presented. The tests were highly successful in that structural integrity of the Fiat passenger compartments was adequately maintained. The AMF vehicle's hydraulic subsystem absorbed a significant portion of the crash energy in its 20 in. stroke, thus offering reduced aggressiveness to the smaller Fiat vehicles.

by S. Davis

Ultrasystems, Inc.

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p615-9 1975 ; 3refs

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 602

## BIG AND LITTLE CAR COMPATIBILITY

A theoretical evaluation of potentials for achievement of vehicle-to-vehicle compatibility through use of improved occupant restraints together with hybrid vehicle front end designs is discussed. The hybrid vehicle front end consists of short stroke, self-force regulating hydraulic cylinder in tandem arrangement with crushable vehicle structure. The improved occupant restraint provides most of the best features of pretensioning, force limiting, early occupant engagement, and good load distribution on the occupant, with resulting restraint functioning efficiencies not otherwise possible. The studies demonstrate a design approach for vehicles which produces vehicle compatibilities in head-on closures of 70 mph between a 1500-

lb car and any other vehicle up to 5000 lbs causing a 29 1/2 inch crush of the small car.

by J. M. Kossar

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Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p620-55 1975 ; 12refs

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 603

## FLEXIBLE EXTERIOR AUTOMOTIVE TRIM

Exterior automotive trim, a rapidly expanding new market for painted, flexible materials, is described. End use requirements, new processes, and functional tests are discussed. The properties of thermoset and thermoplastic elastomers now used or being considered for painted sight shields or filler panels in energy absorbing bumper systems, and for painted, full front and rear flexible skin systems, are presented.

by J. T. Lange

E. I. duPont de Nemours and Co., Elastomer Chemicals Dept.

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p656-64 1975

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 604

## COMPATIBILITY ON THE ROAD

The complex problem of compatibility in road traffic is discussed. The problems of pedestrian protection and car-car, car-truck, car-fixed obstacle collisions need to be solved with the highest degree of priority. The automobile designer can contribute more effectively by dealing with the second group. It is essential to learn even more about traffic accidents and about the crash performance of the vehicles of other manufacturers. It is also necessary to know the change in velocity of the vehicles under crash conditions as a function of masses of the collision partners. The development of a deformable representative vehicle must be done with the highest priority.

by U. Seiffert

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Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p665-9 1975 ; 6refs

Conference held in London, 4-7 Jun 1974.

Availability: IN HS-016 557

HS-016 605

## COMPATIBILITY BETWEEN VEHICLES IN FRONTAL AND SEMI-FRONTAL COLLISIONS

The speed variation that vehicle occupants undergo in a colli-

sorbing the same quantity of energy, and at the same time protecting their occupants. It is also shown that it is possible to verify the compatibility of all vehicles with a barrier whose mass and deformation-stress characteristic depend on the mass of the vehicle to be tested.

by P. Ventre  
Renault State-Owned Works, Crashworthiness Dept., France  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p670-3  
1975

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HS-016 606

### **RELATIONSHIP BETWEEN VEHICLE FRONT-END DEFORMATION AND EFFICIENCY OF SAFETY BELTS DURING FRONTAL IMPACT**

Crash tests conducted after theoretical studies confirmed that the efficiency of a safety belt system may be improved by influencing the deformation characteristics of the vehicle front-end. It was possible to overcome quickly belt slack, to obtain a small relative velocity between occupant and vehicle up to the point of increase of forces, and to assure that belt forces increase slowly in such a manner that the change of rotational angular velocity of an occupant's head is smaller than in comparable vehicles. It was shown how the individual major structural elements could be experimentally evaluated and corresponding modifications in design could be made in order to make better use of the development potential which is still inherent in all safety belt systems.

by J. Elsholz  
Bayerische Motoren Werke AG, West Germany  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p674-81  
1975 ; 3refs

Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 607

### **THE FORD AUTOMATIC SAFETY BELT SYSTEM**

The Ford automatic safety belt system is described in terms of component functions and advantages. Details are given on system performance in entrance and exit, braking under normal driving conditions, front impact and multiple impacts, side impact and rollover, and emergency release of occupants after an accident. It is concluded that the system is a great improvement over today's three-point belt system, offering a safety package with high accident protection for the occupant at acceptable economic costs.

by E. Hellriegel; A. Rauthmann  
Ford Motor Co., Body Advanced Engineering  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p682-6  
1975

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HS-016 608

### **STRUCTURAL AND OCCUPANT PROTECTION SYSTEMS OF THE OPEL SAFETY VEHICLE**

The Opel Safety Vehicle (OSV) program is directed toward the development of a 2000-lb passenger car concept based on high volume production technology and the utilization of conventional materials to achieve the highest level of safety performance within these parameters. Research work with foam filled structural elements is described, along with other reinforcements and safety related modifications. Safety features include: modified front structure and steering system; three point restraint system using a 4% stretch webbing; front bucket seats; and crush resistant occupant compartment design.

by E. S. Kiefer  
Adam Opel AG, West Germany  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p687-91  
1975

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HS-016 609

### **SOME CONSIDERATIONS OF BODY STRUCTURE CRUSHABILITY IN RELATION TO IMPACT SPEED**

Some elements are provided for a numerical answer to questions of body structure crushability, based on experimental results and theoretical estimations; and an analysis is provided of the total behavior of body structures, dealing only briefly with restraints. Structural considerations are reviewed along with kinematics and energy management aspects, such as energy-absorbing capacity, the relation between the impact velocity and the deformed mass, and vehicle weight increase versus barrier impact speed. Analysis of the behavior of vehicle structures, carried out with the proposed calculation method, supports the following: the design of current structures, during normal use, does not provide high absorption capacity in a collision; current structures are able to withstand collisions at moderate velocities without dangerous compartment deformation; to increase the capability of given vehicles to absorb higher impact speeds without incurring passenger injuries, the total vehicle mass must be increased in relation to the square of the determined, critical impact speed; mass increase is affected strongly by structural efficiency; and in trade-offs between impact speeds and dangerous deformation of the passenger compartment, increase the absorbing mass without trying to change the structural efficiency.

by L. Rosti-Rossini  
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Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p692-8  
1975

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HS-016 610

### A RESEARCH STUDY FOR AN ENERGY ABSORBING SLIDING SEAT

In its present form, the energy-dissipating sliding seat concept offers notable advantages over the conventional fixed seat-and-belt arrangement. Optimization of the systems appears to be advisable. Focus is on the concept of restraining the occupant directly onto the seat by belts more rigid than those currently in use and of having the seat move relative to the car body instead of being fixed. Test results showed that, with the sliding seat, reductions are obtained in accelerations of both the head and thorax, and in seat belt loads.

by G. Danese

Rome Motor Vehicles Testing Center, Italy  
 Publ: HS-016 557, INTERNATIONAL TECHNICAL  
 CONFERENCE ON EXPERIMENTAL SAFETY  
 VEHICLES (STH), Washington, D.C., 1975 p699-702  
 1975

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HS-016 611

### SOME METHODS OF ABSORBING THE ENERGY OF MOTOR VEHICLES AND THEIR OCCUPANTS

Progress which has been made on various methods of absorbing energy to help protect vehicle occupants and reduce damage costs is reviewed. Consideration is given to bumper design, bumper mountings, rubber/plastic composites, laminated windshields, and material strengths.

by P. Watson

Transport and Road Res. Lab., England  
 Publ: HS-016 557, INTERNATIONAL TECHNICAL  
 CONFERENCE ON EXPERIMENTAL SAFETY  
 VEHICLES (STH), Washington, D.C., 1975 p703-9  
 1975 ; 6refs

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HS-016 612

### VEHICLE COMPATIBILITY IN CAR-TO-CAR SIDE IMPACTS AND PEDESTRIAN-TO-CAR FRONTAL IMPACTS

Follow-up commentary is presented for films from British Leyland on vehicle compatibility. Focus is on the two-door coupe, with mention made of proposed modifications, impact tests and test methods. It is shown that a car having a low, energy absorbing bumper coupled with an angled front end profile, can materially effect the results of a side impact even when impacting a reinforced safety vehicle. It is recommended that national and international bumper heights be established.

by P. M. Finch

British Leyland Motor Corp., Ltd.  
 Publ: HS-016 557, INTERNATIONAL TECHNICAL  
 CONFERENCE ON EXPERIMENTAL SAFETY  
 VEHICLES (STH), Washington, D.C., 1975 p710-11  
 1975

Conference held in London, 4-7 Jun 1974.

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HS-016 613

### THE APPLICATION OF COMPUTER SIMULATIONS IN VEHICLE SAFETY

The application of computer simulation techniques has proved to be an extremely useful design aid, ensuring that maximum value is obtained from experimental data, and enabling design studies to be undertaken in which many alternative schemes can be considered. Comparison of actual barrier test data with predicted results has shown that very good correlation is obtained. The accuracy of the predictions is largely due to the selection of a simulation model which adequately described the vehicle configuration, and the use of realistic stiffness characteristics which are determined experimentally.

by W. C. Emmerson; J. E. Fowler

British Leyland Motor Corp., Ltd.  
 Publ: HS-016 557, INTERNATIONAL TECHNICAL  
 CONFERENCE ON EXPERIMENTAL SAFETY  
 VEHICLES (STH), Washington, D.C., 1975 p712-20  
 1975 ; 4refs

Conference held in London, 4-7 Jun 1974.

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HS-016 614

### THE ROLE OF EXTRUSION DEVICES IN ENERGY ABSORPTION FOR SAFETY

Although the current U.S. legislation for bumper energy-absorbing systems requires the use of recoverable systems, there are many areas where one-shot devices may be very cost effective in improving the safety performance of the vehicle. In particular, an extrusion device behind a soft front or recoverable shock-absorber system may offer the cheapest means of providing vehicle and passenger protection in high speed impacts. An extrusion device has the advantage that, up to the limit of the available stroke, the force remains sensibly constant over a wide range of impact velocities. These devices are also well suited for use in advanced seat belt restraint systems, where the constant force characteristic is of value.

by K. Deutsch; M. G. J. Elson; R. W. Moore

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 England

Publ: HS-016 557, INTERNATIONAL TECHNICAL  
 CONFERENCE ON EXPERIMENTAL SAFETY  
 VEHICLES (STH), Washington, D.C., 1975 p721-4  
 1975

Conference held in London, 4-7 Jun 1974.

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HS-016 615

### THE DUNLOP MK 2 COMPOSITE ENERGY ABSORBING BUMPER SYSTEM

The MK II composite energy absorbing bumper mountings are designed to rigidly support a conventional bumper bar, and to deflect under impact in such a way as to absorb the energy associated with low speed collisions with optimum efficiency over a wide range of operating temperatures. The design takes advantage of recent Dunlop Research Division developments in the fusion bonding of plastic and rubber in order to produce light weight and cost effective units which will eliminate vehicle damage without significantly increasing the vehicle weight or affecting the vehicle operating costs. The development and

performance of the Dunlop energy absorbers are detailed in relation to current and anticipated safety standards. Further developments concerning energy absorbing flexible bumper bars and soft front ends are also discussed.

by D. A. Newton

Dunlop Ltd., Advanced Products Group, England  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p725-8  
1975

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HS-016 616

## **ENERGY ABSORPTION BY VARIABLE SHEAR STRENGTH DUPLEX MATERIALS**

Duplex elements for the reinforcement of polymer or metal matrix composites have been produced consisting of convoluted high strength core wires in small bore stainless steel tubing. The interface between the core and sheath is purely frictional and its shear strength is controlled by the local tensile load in the core. As the load on the core increases the shear strength of the interface decreases until the core may be withdrawn at a constant load determined by the geometrical and physical properties of the two components. Experimental composites consisting of duplex elements in a polymer matrix have been made and tested statically and in impact up to 600 ft/sec. A simplified form of duplex device suitable for constant load linear extension has been produced consisting of either crimped steel strips or helically crimped wires clamped in a parallel slot between flat steel plates. Such devices have been produced capable of extending more than 12 in. at substantially constant load at up to 50 ft/sec. Some effects of different frictional materials on the dynamic and static performance of these devices have been investigated. In an alternative form of duplex element, the extension is produced by the controlled tensile collapse of a high strength tube. Experimental composites of this type have also been tested in the laboratory. A number of potential applications, both in the road transport industry and elsewhere, have been examined and a variety of designs for such devices are described.

by R. S. Millman; M. J. Chappell

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Technology, England

Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p729-39  
1975 ; 8refs

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HS-016 617

## **OCCUPANT PROTECTION IN FRONTAL IMPACTS: A STATIC, PASSIVE RESTRAINT SYSTEM**

The development and testing of front passenger and rear passenger restraints are reviewed. Consideration is given to passive restraints, composite systems, windshield glass, appraisal buck, static and dynamic tests, sled and barrier test results, and phenolic foams. Five initial restraints were made and sled tested to establish dummy kinematics and restraint collapse characteristics (four made of 0.75 mm sheet metal of varying configuration and one of rigid phenolic foam, 24 kg/cu.m den-

sity with metal inserts and a polyvinyl chloride cover). Analysis of test results indicated insufficient collapse with the foam restraint and excellent collapse characteristics with the metal ones. A 48 km/h barrier impact test conducted with these restraints showed that required occupant protection levels had not been met with an all metal restraint. After testing an expanded metal beam concept restraint with good results, a composite restraint system, using expanded metal as a core in a moulded phenolic rigid foam with an outer cover, was static tested. Results showed vast improvement, with these advantages over sheet metal restraints: elimination of extremely stiff areas remaining after deformation; soft feel of the restraint before and after impact; more acceptable collapse characteristics with controlled deformation in chest beam and support legs of the restraint; and weight saving. Sled tests confirmed the high success potential of the static tests. Conclusions to date include: occupant protection is possible in a 48 km/h frontal barrier impact using the type of static passive system described; restraint collapse characteristics and the large chest contact area can result in acceptable protection levels; modifications are required to reposition the windshield and header rail for optimum front passenger head protection; with correct dummy kinematics and vehicle package, the windshield can be an effective head restraint; and rear restraints have been consistently successful in meeting the specified occupant protection criteria.

by W. Egglestone; G. D. Suthurst

Ford Motor Co., Ltd., England

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CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p748-59  
1975

Conference held in London, 4-7 Jun 1974.

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HS-016 618

## **OCCUPANT PROTECTION IN REAR IMPACT**

Although a substantial weight penalty has been introduced, it has been shown possible to provide occupant protection and maintain fuel tank integrity in a rear impact approximately equivalent to an 80 km/h vehicle-to-vehicle impact. The principle of providing collapse space for the fuel tank was successful, and elimination of protrusions close to the fuel tank reduced the risk of puncture. Other fuel tank installation modifications were proposed to decrease the risk of postcrash fires. The simple rear seat head restraint was effective in reducing dummy head accelerations. Further accident and injury data is required to determine the cost effectiveness of reinforcing the front seats. The 8 km/h no damage bumpers imposed a high penalty in terms of cost and vehicle performance. It is recommended that no higher-level of bumper requirement be specified than the relevant ISO Exterior Protection practice.

by D. Burland

Ford Motor Co., Ltd., England

Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p760-8  
1975 ; 16refs

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

## **OCCUPANT PROTECTION DURING VEHICLE ROLLOVER**

In the first rollover tests with unrestrained occupants, the measured injury levels were low and occupant ejection did not prove to be the problem expected from studies of accident data. In no case did complete dummy ejection occur, probably because no doors opened during rollover. The fitting of seat belts greatly reduced the partial ejection that otherwise occurred, and the retention of the windshield throughout rollover virtually eliminated it. However, using seat belts resulted in a change of injury pattern from partial ejection of limbs, to head impacts with the car interior. In assessing the significance of this trade-off in injury types, two factors are important: the test being used is an extremely severe one in the number of rolls it produces; and most rollovers in the real world will involve, at their beginning and probably at other points as well, longitudinal vehicle decelerations that will influence dummy kinematics and increase the beneficial contribution of seat belts. Investigations into the effects of roof strength, by means of roof crush tests, have not been completed, but it appears that moderate changes to the normal roof strength of the model tested may have less significant effects on occupant dynamics than would changes in occupant restraint and interior padding. In particular, the test on a strengthened vehicle suggest that increased roof strength can result in less absorption of vehicle kinetic energy through vehicle damage in the early stages of the rollover, and, therefore, increase the number of rolls and the distance covered. This increases the likelihood of occupant vehicle interior impacts, and the chance of the rolling vehicle hitting another vehicle or obstacle.

by K. Stone  
Ford Motor Co., Ltd., England  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (STH), Washington, D.C., 1975 p769-84  
1975, 2 refs  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 620

### **A PRACTICAL APPROACH TO THE PROTECTION OF MOTOR VEHICLES BY THE ABSORPTION [ABSORPTION] OF IMPACT ENERGY**

Consideration is given to devices which reduce the initial severity of the impact between a vehicle and an obstruction, at either slow or fast speeds. Design criteria are outlined for energy absorbing bumpers, and the evolution of a practical design is discussed. The mathematical treatment of design problems is examined in some detail.

by G. Persicke; F. I. Plant; J. R. Child  
Road Res. Ltd., England  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (STH), Washington, D.C., 1975 p785-8  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

## **DESIGN AND MANUFACTURE OF AUTOMOBILE BUMPERS**

Design and developmental aspects of automobile bumper manufacturing are examined briefly. Consideration is given to impact surfaces and angles, as well as to various materials such as elastomers. Properties of EDPM are commented on.

by I. M. Thomson  
Enersorb Ltd., England  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (STH), Washington, D.C., 1975 p789-92  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 622

### **REVIEWS ON ACCURACIES AND RESULTS OF ESV COLLISION TESTS**

Test measuring equipment and techniques are introduced, data reduction methods and their feasibility are discussed, and some details are given on results from Nissan and Toyota experimental safety vehicles. Dummy head acceleration analysis is examined along with vehicle compartment acceleration analyses.

by M. Sakimura  
Japan Automobile Res. Inst., Inc. (J.A.R.I.)  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (STH), Washington, D.C., 1975 p793-5  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 623

### **CHARACTERISTICS OF BODY ENERGY ABSORPTION AND RESTRAINT SYSTEM**

The relation of various vehicle crash pulses having the same crash stroke to the occupant's injury is examined, along with the effect on vehicle occupants of the frequency and amplitude of high frequency components appearing in the vehicle crash pulse as a result of buckling of structural members of the vehicle. Also discussed is the effect on vehicle occupants of combinations of vehicle crash pulses and times required to operate an emergency locking retractor used on the shoulder belt. Computer simulation studies of the effects of vehicle crash characteristics and ELR locking time on head injury criteria (HIC) of occupants give the following conclusions: a square wave crash pulse is the most suited to small vehicles; high frequency components in excess of 50 Hz superimposed on a crush pulse have little effect on HIC; it is important for a crash pulse to have a good rise in the beginning for utilization of the ride down effect; with respect to ELR locking time,

quicker is better, but the better the initial rise a crash pulse has, the quicker the locking time must be.

by K. Higuchi

Honda Motor Co., Ltd., Japan

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p796-800 1975

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 624

### **DETERMINATION OF MOTOR VEHICLE CHARACTERISTICS AFFECTING DRIVER HANDLING PERFORMANCE**

The experimental approach of a study to assess the interaction of driver and vehicle is summarized. Objectives of the study are: to identify the more significant vehicle handling and stability performance parameters in maneuvering situations requiring extreme vehicle dynamic performance; to determine and assess the extent to which a representative sampling of vehicle drivers utilize the full capacity of the vehicle with respect to the significant vehicle response and feedback characteristics identified above; and rank those parameters of vehicle handling and stability relative to their importance in the vehicle driver combinations in accident avoidance maneuvers. It is hoped that the results of this study will form the basis for refining open-loop test and data analysis methodology to permit closely controlled and reproducible tests to be conducted, and the results objectively analyzed to give measures of vehicle handling performance that are meaningful in real-world driving situations.

by G. G. Hayes

Texas A and M Univ., Texas Transportation Inst.

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p805-9 1975

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 625

### **DRIVER/VEHICLE RESPONSE RESEARCH**

Driver vehicle interactions and time effects are examined by measuring driver response and performance properties for a range of driving task variables, including: vehicle directional response configurations, normal and emergency maneuvers, random and discrete disturbances, and task durations. The vehicle handling configurations are discussed, along with the maneuvers and test sequences, and the processing and analysis of the response and performance data.

by R. H. Kleim

Systems Technology, Inc.

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p810-3 1975

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 626

### **THE RELATION BETWEEN VEHICLE HANDLING AND ACCIDENT AVOIDANCE**

Vehicle handling as a scientific and technical problem is superimposed by the statistical problem of utilization of handling in emergency situations. The importance of and methods for obtaining information on the following aspects are outlined: the reaction of the driver in the extraordinary and unprecedented stress situation of foreseeing a possible, imminent accident; probability data of steering motions and pedal actuations before real accidents; probability data on types of maneuvers which are carried out before real accidents; and probability data on weather and operating conditions during accidents.

by K. Enke

Daimler-Benz AG, West Germany

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), Washington, D.C., 1975 p815-7 1975

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 627

### **MEASUREMENT OF TRANSIENT SLIP ANGLES OF TIRES--A CONTRIBUTION OF EVALUATING SAFETY-RELEVANT DRIVING CONDITIONS**

The application, under critical driving conditions, of the curves of lateral force as a function of slip angle, which are almost always used and obtained by means of a tire test stand with constant or only gradually changing parameters, was evaluated. The slip angle of a rolling wheel was varied according to a time dependent sine function. The pivot axis was the vertical axis of the wheel; the camber was set to zero. The slip angle was varied symmetrically about the rest position; the slip angle amplitude and the excitation frequency were varied. The results of a typical test with given parameters are given. The region which was possible to examine was limited. The precision of the measurements is enhanced when the tires exhibit a small lateral force value and show good uniformity. The experimental and theoretical results compared well with those of Pacejka.

by R. Weber

Porsche AG, West Germany

Publ: HS-016 557, INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5th), Washington, D.C., 1975 p818-22 1975 ; 12refs

Conference held in London, 4-7 Jun 1974.

Availability: In HS-016 557

HS-016 628

### **SAFETY AND MOTOR VEHICLE EQUIPMENT**

Examples are shown of techniques and devices for increasing the active and passive safety of vehicles. These include headlamp leveling systems polarized headlamps, antiskid systems, and devices for relieving the driver (power steering, power brakes, automatic transmission, speed control for maintaining constant speed, air-conditioning, and adjustable seating). Sidewind compensation and devices for monitoring the

operational safety of a vehicle are also discussed. Traffic warning broadcasts and devices for driver supervision are mentioned. It is essential that, by means of many of these devices, a considerable improvement in safety be achieved with relatively low expenditure.

by H. Manger  
Robert Bosch G.m.b.H., West Germany  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5th), Washington, D.C., 1975 p623-8  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 629

## IMPROVING DIRECTIONAL STABILITY UNDER BRAKING

The effects of unequal braking forces on the directional stability of the vehicle are considered with emphasis on asymmetric braking forces, the inboard scrub radius; the zero scrub radius, and the outboard scrub radius stabilizing effect under braking. Results are presented for tests carried out with a conventional front suspension with an inboard scrub radius of 62 mm and with a McPherson front suspension with an outboard scrub radius of 18 mm and floating caliper brakes. Three advantages of diagonally split brake circuits with outboard scrub radius on front wheels are outlined. These are: vehicle behavior under braking remains constant when one circuit fails, because it is still the braked front wheel which will lock first; the vehicle does not pull to one side even when two diagonally opposite wheels are braked because yaw is compensated by the outboard scrub radius; and neither braking stability nor steering control is lost when one circuit fails because two wheels always generate lateral forces even when the two braked wheels have locked.

by D. Banholzer  
Audi NSU Auto-Union AG, West Germany  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p829-35  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 630

## FURTHER RESEARCH ON THE DRIVER/VEHICLE SYSTEM STUDY OF BRAKING IN A TURN

A mathematical model is used to simulate the relationship between the extrapolation time of a trajectory and the reaction time of a driver and vehicle. The model forecasts the behavior of the driver vehicle system in various types of maneuvers. Application of the model to braking in a turn is described. The examples shown indicate the effects of braking distribution between front and rear on the vehicle stability and therefore on the degree of engagement of the driver.

by F. Surace  
Alfa Romeo, Italy  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p836-41  
1975 ; 6refs  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 631

## THE STOP LAMP: SOME OPTIMUM VISIBILITY CONSIDERATIONS

Rear lamp visibility optimization is carried out with particular reference to the stop lamp. The stop lamp described seems to assure a night and day visibility comparable to or better than the present double level lamp, with lower glare. The drawbacks are sensitivity to the height difference between the driver eye and the stop lamp, which requires low mounting height for the lamp, and the necessity for a good aiming of the lamp. With regard to the possibility of indicating the vehicle deceleration through a variable luminous area stop lamp, nothing prevents the use of many lamps (typically three or four) near one another horizontally, except a probable luminous intensity reduction. The higher the deceleration, the higher could also be the number of lamps lit.

by P. Soardo  
Istituto Elettrotecnico Nazionale Galileo Ferraris (IEN), Italy  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p842-6  
1975 ; 14refs  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 632

## SAFETY ASPECTS OF DENOVO RUN FLAT TIRES

The development and testing of Denovo run flat tires, which provide safe mobility following a puncture, are traced. Information is given on how a vehicle's stability and handling was affected with a flat tire on one of its corners, in both wet and dry conditions, and the safety level of the Denovo tire/wheel unit after a high speed blowout or a slow leak, failsafe testing, burst data, and statistics on punctures and motorist ability to deal with them. Deflation warning devices and inflated performance of the Denovo tire are briefly commented on. Servicing tests showed no problems caused by the Denovo tire even when service was carried out by inexperienced personnel. It is now widely recognized that the Denovo concept has created a new situation in tire technology and usage. There are significant gains in overall safety and user convenience. Additionally, vehicles with more efficient space utilization can now be designed, without the need for a fifth wheel.

by T. Holmes; T. French  
Dunlop Ltd., Tire Technical Div., England  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p847-55  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 633

## FACTORS LEADING TO LOSS OF CONTROL--A GUIDE FROM ACCIDENT INVESTIGATIONS

Human, environmental, and vehicle factors in loss of control accidents are reviewed based on accident investigations in the Austin-Morris Division of British Leyland Motor Corp. The influence of braking on traction is discussed as well as loss of



control on icy surfaces, cost effectiveness, loss of control without braking, and experimental safety vehicle specifications and developments in the United Kingdom.

by G. Jones  
British Leyland Motor Corp., Ltd.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D. C., 1975 p856-61  
1975; 7refs  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 634

## DRIVERS' LIMITATIONS

Accident prevention and parameters which influence driver performance are discussed, based on the concept of the driver of a vehicle being considered as an element in the man-machine system. The contribution of accurate perceptual judgments is examined. Devices currently under investigation in the United Kingdom, both for use on vehicles and in the environment, are described, including radar systems, electronic speed controllers, a head-up display speedometer, a station keeping indicator, and an automatic headlight dimming system. Other factors mentioned which influence driver performance are time, information systems, environmental effects, and speed factors.

by H. A. J. Prentice  
Transport and Road Res. Lab.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p862-7  
1975  
Conference held in London, 4-7 Jun 1974  
Availability: In HS-016 557

HS-016 635

## THE PUNCTURED PNEUMATIC CAR TIRE FROM THE USER'S VIEWPOINT

The effects of tire failures of conventional tires on vehicle controllability are analyzed with focus on those aspects of tire behavior which can contribute to loss of vehicle control under unforeseen circumstances and be extremely hazardous. Conventional tires are compared with a new range of safety tires and safety wheels under the following headings: significant tire pressure mismatch; sudden deflation (blow-out); slow puncture; curb damage to carcass; and total tire failure. The results of many tests carried out under extremes of conditions rarely met in the United Kingdom, as well as in typical everyday situations, are weighed, and related to real and simulated accident producing contingencies. These included snow, black ice, flooded roads, and surfaces varying from loose broken to highly polished ones, from slippery to bone dry, from new motorway to unmaintained roads. Results are reviewed for three test series: Dunlop Denovo tire testing on a Ford Escort 1100, flat to complete destruction tests in Dunlop Denovo on a Ford Escort 1100, and Dunlop Denovo tire testing on Rover 3500.

Diagrams of loss of control patterns and photographs of post test tires and rims are included.

by M. A. Jacobson  
Automobile Assoc.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p868-93  
1975  
Conference held in London, 4-7 Jun 1974.  
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HS-016 636

## CHARACTERISTICS OF JAPANESE ESV TIRES

Results are outlined for tests of experimental safety vehicle (ESV) tires which were tested in parallel with accident avoidance tests of Japanese ESVs. Laboratory and field tests were conducted on two ESV tires (6JX14 and 5 1/2JX14), one conventional tire (5JX14), and one ASTM standard tire (5JX14) to determine cornering power at large slip angles, at large camber angles, and under wet road conditions. Braking characteristics on various pavements and the brake system efficiency of the ESVs are described. The relationships between vehicle sideway force and longitudinal force coefficients are also considered.

by H. Sakai  
Japan Automobile Res. Inst., Inc. (JARI)  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p895-905  
1975; 4refs  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 637

## STEERING AND HANDLING CHARACTERISTICS OF A VEHICLE WHEN FAIL-SAFE TIRE IS DEFLATED

The steering and handling characteristics of combinations of fail-safe tires (165/70 SR 13 or 185/60 R13) and front drive test cars (Honda experimental safety vehicle specifications) were evaluated in slalom tests. A quantitative prediction based on equations of motion of the effects of tire characteristics and vehicle design parameters on cornering performance is given, along with a model of desirable fail-safe tires. Summarized results in relation to tire characteristics are: increase in the rolling resistance as a result of tire deflation exerts a large effect on the steering correction during running with a tire deflated, but has only a small effect on the steering characteristics; tire deflection as a result of deflation has only a small effect on the steering characteristics within the range of low centripetal accelerations; difference in the cornering characteristics between normal performance and performance with a front or rear wheel deflated is determined mainly by the rate of decrease in the cornering power of a deflated wheel to a normal wheel; difference in the characteristics of turns in the different directions is determined mainly by the difference in the rate of change of the cornering power with respect to the load between a normal and a deflated tire; and other tire characteristics have only a small effect on the cornering characteristics of a vehicle when a tire is deflated. Summarized results for vehicle characteristics are: variation of the characteristics due to the direction of turn with a deflated tire is controlled by the roll stiffness distribution of the deflated

tire; parameters of the vehicle have only a marginal freedom that may be altered for the sake of tires; and it may be possible to improve the characteristics of a vehicle with a deflated tire by tire capacity selection, or by increasing the roll understeer characteristics of the vehicle.

by S. Sano  
Honda Motor Co., Ltd.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p906-23  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 638

### **THE EVALUATION OF SAFETY, ENERGY, AND ENVIRONMENTAL FACTORS IN THE AUTOMOTIVE TRANSPORTATION SYSTEM**

An overview is given of U.S. program activities to analyze the costs, benefits, and tradeoffs involved in satisfying the conflicting requirements of safety, environmental control, and conservation of energy. Programs cited include automotive safety and the control of emissions, automotive energy efficiency, safety vehicle development, alternatives to the internal combustion engine, and the integrated Vehicles/Highway System approach to safety.

by W. C. Steber  
Department of Transportation, Systems Devel. and Technology  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p929-31  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: HS-016 557

HS-016 639

### **AN OVERVIEW OF THE U.S. GOVERNMENT PROGRAM TO EVALUATE ALTERNATIVE POWERPLANTS TO THE CONVENTIONAL INTERNAL COMBUSTION ENGINES FOR AUTOMOBILES**

The basis for the U.S. governmental program to evaluate alternate powerplants in the automotive application is explained. The status of the program is described, and the relationship of this program to other U.S. government-sponsored research programs that involve safety, emissions control, and conservation of energy for automobiles is discussed. The AAPS program evaluates alternative powerplants to the conventional internal combustion engine. The advent of the petroleum energy shortage highlighted the need for more intensive research and development on domestic energy sources, on improved energy conversion, and on means to effect a reduction in energy con-

sumption. Development activities with the Rankine and Brayton cycle systems are briefly discussed.

by J. J. Brogan  
Environmental Protection Agency, Alternative Automotive Power Systems Div.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p932-6  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 640

### **RESEARCH SAFETY VEHICLE CRASH EFFECTIVENESS METHODOLOGY**

Systems analysis procedures for maximizing vehicle safety, summarized based on a study by Versace and Henson which appended. The procedures are related to specifications a design analyses for the development of a 3000-lb research safety vehicle. In the approach used, the characteristics various hardware arrangements are established or provisions assumed, and a determination is made of the system's probable effectiveness by calculating crash inputs. Variations in basic design elements of the vehicle are tried by simulation until that combination of variations is found which predicts maximum safety performance achievable. Probable distribution of exposure to accident events, as projected to the 1985 time frame is considered. Injury scaling used in the model focuses on the conversion of dynamic response into a probability of survival. System effectiveness is determined by multiplying the relative effectiveness, or probability of survival given that the crash takes place, with the probability of being exposed. The product of these two functions is integrated across the whole speed spectrum, yielding the relative number of lives that would be saved.

by J. J. Edwards  
Ford Motor Co.  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (5TH), Washington, D.C., 1975 p937-45  
1975 ; 6refs  
Conference held in London, 4-7 Jun 1974. Includes complete text of paper by J. Versace and S. Henson.  
Availability: In HS-016 557

HS-016 641

### **BENEFIT/COST ANALYSIS AS A BASIS FOR DECISIONS IN THE AUTOMOTIVE INDUSTRY**

Cost-benefit analysis as applied to safety measures in road traffic is examined. Cost-benefit ratios for occupant protection in frontal vehicle impact, in rear end collisions, and in side impacts are discussed. Based on the expectations of damage from past experience, the cost-benefit analysis offered possibility of finding the maximum benefit for the planned delay of cost, the maximum possible reduction of damage for given cost. Variations in the anticipated damage influence cost-benefit analysis, just as material shortages resulting price increases influence the cost aspect. By employing

achieve continuous improvement through a rational basis.

by E. Fiala  
Volkswagenwerke AG, West Germany  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (STH), Washington, D.C., 1975 p947-50  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 642

## **COST-EFFECTIVENESS STUDY**

Cost effectiveness studies on vehicle safety measures and devices in France are described. The studies are based on establishment of the costs, assessment of the effectiveness, and appraisal of the total effect in order to obtain the benefit. A basic problem is the valuation of life, the point of view according to which such value is fixed, the various factors to be taken into account in the calculation, and the a priori socio-economic assumptions made. It is recommended that efforts be used to develop comparative studies, to pinpoint definitions, and to check the consistency of the concepts used and the validity of the results.

by N. Muhrad  
Organisme National de la Securite Routiere, ONSER, France  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (STH), Washington, D.C., 1975 p951-5  
1975; 4 refs  
Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 643

## **A FEASIBILITY STUDY ON SMALL SAFETY VEHICLES**

The development status of the Nissan four-passenger, lightweight safety vehicle is reviewed. The specifications of the Nissan experimental safety vehicle (ESV) were essentially the same as those of the U.S. ESV regarding fulfillment of the requirements in 80 km/h frontal barrier collisions, except for some minor changes; specification requirements for 80 km/h rear-end collisions were modified to 65 km/h as a result of a close review of accident analysis and other related data. Experimentally, the Nissan ESV has satisfied all ESV specifications and requirements; but it is not yet a practical vehicle. Results of cost analysis of occupant crash protection and accident avoidance are given. Future small car safety is examined, including lessons learned from accident analysis, vehicle compatibility in car to car collisions, pedestrian safety in low speed collisions, and accident avoidance requirements. Future vehicle environment is briefly considered. A feasibility study on small safety vehicles tabulates performance and specifications of the Nissan ESV.

by Y. Serizawa  
Nissan Motor Co., Ltd., Japan  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (STH), Washington, D.C., 1975 p959-73

Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 644

## **COST-BENEFIT ANALYSIS OF BUMPER SYSTEMS FOR SMALL CARS**

Cost-benefit analyses were made on the 1972 and 1974 Toyota Corolla model bumper systems, a no-damage bumper system, and a no-damage polyurethane bumper system. Findings show that: from a cost-benefit standpoint, the 1974 Toyota Corolla bumper system is more economical than the 1972 system; the bumper system which sustains no damage during 10 mph impacts would not work on the small car from the vehicle performance and cost-benefit standpoints; in the near-future it seems likely that, with new technology, it will be possible to develop an economically beneficial no-damage bumper system, effective in 5 mph impacts, for the small car.

by T. Iida  
Toyota Motor Co., Ltd., Body Engineering Design Dept., Japan  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (STH), Washington, D.C., 1975 p974-8  
1975  
Conference held in London, 4-7 Jun 1974.  
Availability: In 016 557

HS-016 645

## **APPLICATION TO REGULATIONS OF STUDIES MADE PURSUANT TO THE ESV PROGRAM**

Vehicle safety regulations are proposed for passenger cars to be implemented in 1980. The regulations should include: passenger cars must pass the front end impact, lateral impact, rear end impact and rollover tests described in broad outline in the European Experimental Vehicles Committee report; and vehicles will have to be equipped with seat belts for all of the passengers (or with some other restraint device of equivalent effectiveness), with the front seat belts being automatically adjustable. Proposals concerning injury criteria are discussed as well as procedures for the application of the new regulations. Specifications for frontal and side impact tests are included.

by A. Osselet  
Publ: HS-016 557, INTERNATIONAL TECHNICAL  
CONFERENCE ON EXPERIMENTAL SAFETY  
VEHICLES (STH), Washington, D.C., 1975 p 987-9

Conference held in London, 4-7 Jun 1974.  
Availability: In HS-016 557

HS-016 646

## **HYDROPLANING AND TREAD PATTERN HYDRODYNAMICS**

The present state of knowledge regarding tire hydroplaning and the influence of squeeze films on wet traction performance is reviewed. Various aspects of hydroplaning phenomena which occur when a tire is traveling in deep or shallow water are discussed, and a control volume analysis is used to derive the Horen hydroplaning equation from fluid momentum theory. A complementary equation for the traveling speed at which squeeze-film penetration (contact detachment) begins is derived from the Bernoulli equation of fluid mechanics. The squeeze-film theory is considered rele-

vant to wet traction phenomena. Fluid inertia effects in squeeze films are analyzed by numerical solution of a recently derived squeeze flow equation which contains local and convective inertia force terms as well as the classical viscous force term. The analysis shows that the water expulsion process is mainly an inertial flow process and that experimental data from the tread pattern effectiveness experiment reported later in the study may be interpreted in the light of inertial flow considerations. The rational selection of two tread pattern performance parameters is described, along with the design and construction of a laboratory apparatus to simulate tread pattern hydrodynamics in the thick-film penetration zone of the tire-road contact region.

by J. F. Sinnamon; J. T. Tielking  
University of Michigan, Hwy. Safety Res. Inst.  
Rept. No. UM-HSRI-PF-74-10; 1974; 126p 25refs  
Sponsored by the Motor Vehicle Mfrs. Assoc. Interim  
Document 7, Proj. 329180, "Tire Traction Characteristics  
Affecting Vehicle Performance"  
Availability: Corporate author

HS-016 647

### DEVELOPMENT OF A COMPUTER SIMULATION TO PREDICT THE VISIBILITY DISTANCE PROVIDED BY HEADLAMP BEAMS

The development of a digital computer simulation program is described which predicts the distance at which a specified target can be seen in opposed and unopposed night driving situations. The analysis is presently restricted to meetings with an opposing vehicle on straight, level roads. The relationship between the glaring intensity and minimum intensity directed at the target to see it is the core of the procedure, which includes a three-stage visual adaptation model to account for glare effects before and after the meeting. The output of the simulation is compared with the results of field experiments for various lateral separations between the vehicles, low and high beams, and targets positioned on the right, left, and center of the lane. Generally, good agreement between the computer simulation and experimental seeing distances are obtained. The simulation should have useful application to evaluate current and proposed headlight beams and other variables, such as lamp aim, affecting beam performance.

by R. G. Mortimer; J. M. Becker  
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,  
Mich. 48105  
Contract UM7204-C128  
Rept. No. UM-HSRI-HF-73-15; 1973; 37p 14refs  
Availability: Corporate author

HS-016 648

### HIGHWAY SAFETY PROGRAMS: HOW DO WE KNOW THEY WORK? NORTH CAROLINA SYMPOSIUM ON HIGHWAY SAFETY, RALEIGH, SPRING, 1974. VOL. 10

Symposium proceedings are presented in which highway safety programs are evaluated in terms of driver improvement programs and interrupted time-series methods for traffic law reform assessment. A full-scale driver improvement program is outlined in which the first step occurs when the licensing agency sends an advisory letter warning the recipient to improve his habits, and the last step is suspension or revocation of his

license. The importance of considering the threats to intervention validity discussed by Campbell is emphasized. Special programs are advocated for different types of drivers, and cost effectiveness and cost-benefit analyses of programs should be included in an evaluative effort. Evaluation is also examined with regard to changes in legal controls, particularly in relation to legislation aimed at controlling errant drivers. Several cases are presented in which before-and-after studies were inadequate to determine whether legislative changes had a true effect, and the British Road Safety Act of 1967 which provided for roadside breath testing for alcohol is described. It is shown that the law did have a genuine effect upon subsequent traffic fatalities, and that the effect was probably brought about by drivers separating their drinking and driving in time and space.

by N. F. Kaestner; H. L. Ross  
Oregon Traffic Safety Commission; University of Denver  
1974; 82p 50refs  
Availability: The Univ. of North Carolina, Hwy. Safety Res.  
Center, Chapel Hill, N.C. 27514

HS-016 649

### PRIORITY RULES AT UNCONTROLLED INTERSECTIONS

Investigation carried out to determine whether amendments to the legislation relating to vehicle priority at uncontrolled intersections in New Zealand is reported. Consideration is given primarily to altering the right-hand-rule, or right-of-way. Legislation in other countries is reviewed briefly, as is case law from the Courts. Accidents at uncontrolled intersections are studied to determine the likely effect of possible amendments on road safety. Driver knowledge of the existing law is also examined. While any amendments are unlikely to result in a significant reduction in total road accidents, the understanding of some aspects of the existing law is found to be poor. Amendments that will simplify the law as it applies to turn vehicles appear justified.

by J. E. Sanderson  
Ministry of Transport, Road Transport Div., Wellington, N.Z.  
Rept. No. TRR-6; 1974; 13p  
Availability: Ministry of Transport, Rd. Transport Div.,  
Private Bag, Wellington, N.Z.

HS-016 650

### DRIVER PERFORMANCE. TRANSPORTATION RESEARCH RECORD 520

Studies of four of the factors that can influence a driver's ability to control his vehicle are treated. The effects of alcohol, occluded vision, carbon monoxide, and aerodynamic disturbance by large vehicles are considered, and the findings will be useful to human factors specialists, safety professionals, enforcement agencies, and researchers in the driver performance field.

by M. Moore, ed.  
Transportation Res. Board, National Res. Council,  
Washington, D.C.  
Rept. No. TRR-520; 1974; 47p 50refs  
Includes HS-016 651 -- HS-016 654 Prepared for the 53rd  
Annual Meeting of the Hwy. Res. Bd.  
Availability: Corporate author

## **DRIVER-VEHICLE CONTROL AND PERFORMANCE IN THE PRESENCE OF AERODYNAMIC DISTURBANCES FROM LARGE VEHICLES**

Procedures for studying the effects of the airflow around a large truck or bus on driver-vehicle systems are discussed. Equations of motion define the lateral-directional dynamics of the vehicle, and multiloop describing functions model the driver's steering response to perceptual cues. The aerodynamic forces and moments can be determined from scale model experiments. The analytical and experimental results show that the following factors can have an influence on driver-vehicle performance in such situations: vehicle handling and aerodynamic properties, driver skill and alertness, ambient wind, configuration and shape of large vehicle, vehicle separation and clearance, and vehicle speeds and relative speeds. In some cases, the disturbance can be large enough to cause the automobile to exceed nominal lane boundaries, despite corrective driver steering control. Investigations showed no important effects on the performance of nominal driver-vehicle systems due solely to the small change in disturbance caused by increasing bus or truck width from 92 to 102 in. Driver-vehicle performance in disturbance situations can be improved by: changing vehicle shapes to reduce disturbance sensitivity, increasing separation between vehicles, increasing relative speed of the overtaking car, reducing large vehicle speed, improving car handling and driver skill, and designing highway geometry and structures to minimize ambient crosswinds.

by D. H. Weir, R. H. Hoh; G. L. Teper  
Systems Technology, Inc. Hawthorne, Calif.

Publ: HS-016 650, DRIVER PERFORMANCE.  
TRANSPORTATION RESEARCH RECORD 520,  
Washington, D.C., 1974 p1-12  
1974 ; 9refs

Sponsored by the Com. on Rd. User Characteristics  
Availability: In HS-016 650

HS-016 652

## **EFFECTS OF CARBON MONOXIDE INTOXICATION ON DRIVING TASKS**

The effects of specific carboxyhemoglobin (COHb) levels on the human physiological response are examined. Laboratory and field measurements of COHb were taken, and the relation of the various levels of COHb to physiological performance, simple and complex psychomotor skills, and driving performance was studied. The complex laboratory tasks related to driving included pursuit tracking, choice reaction time, and dual tasks. The driving performance studies investigated vehicle dynamics such as velocity and spacing during car following; operator control movements such as steering wheel, gas pedal, and brake pedal applications; and perceptual measures, such as driver's visual search and scan patterns measured with the Ohio State University eye-movement camera technique.

by T. H. Rockwell; F. W. Weir

The Ohio State Univ.; General Motors Corp.  
Publ: HS-016 650, DRIVER PERFORMANCE.  
TRANSPORTATION RESEARCH RECORD 520,  
Washington, D.C., 1974 p13-24  
1974 ; 33 refs

Sponsored by the Com. on Rd. User Characteristics  
Availability: In HS-016 650

## **A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF AUTOMOBILE PATH DEVIATIONS WHEN DRIVER STEERS WITH NO VISUAL INPUT**

Theoretical and experimental investigations were conducted of automobile path deviations when a driver is attempting to steer his vehicle along a straight path with his vision occluded. A three-factor (car, subject, speed), two-level field experiment was carried out to test for main and interaction effects. Another field experiment was carried out to determine the effects of no steering control. In both experiments, the vehicle path deviations from the theoretical straight path were measured over several hundred feet and were used as the dependent variable. Both experiments were conducted on a flat airport runway under daylight and no-wind conditions. The experimental results indicate no significant car or subject effects but a highly significant speed effect and a significant car-subject interaction. The standard deviations of the vehicle displacements from the theoretical straight path are considerably smaller at the higher speed for a given distance traveled under occluded vision. The standard deviations of vehicle displacements for a given distance traveled are considerably larger for the no steering control condition than for the steering control condition with no visual input. The experimentally obtained data seem in basic agreement with the theoretical path deviation model. Based on the experimental data, the distribution of vehicle displacements for a given distance traveled under no visual input could be reasonably approximated by a normal distribution.

by H. T. Zwahlen; K. N. Balasubramanian  
Ohio State Univ.

Publ: HS-016 650, DRIVER PERFORMANCE.  
TRANSPORTATION RESEARCH RECORD 520,  
Washington, D.C., 1974 p25-37  
1974 ; 6refs

Sponsored by the Com. on Rd. User Characteristics  
Availability: In HS-016 650

HS-016 654

## **TRENDS IN BLOOD ALCOHOL CONCENTRATION LEVELS OF NIGHT DRIVERS**

As part of the Fairfax Alcohol Safety Action Project (ASAP), two roadside surveys were conducted in Fairfax, Virginia. A base-line survey was conducted in January, 1972 prior to the start of ASAP operations in February, 1972, and a second survey was conducted in October, 1972. The ASAP concept recognizes the major role that alcohol plays in fatal and serious highway crashes, and the project consists of countermeasures designed to identify drunken drivers, remove them from the road, and refer them to proper educational or rehabilitation programs. The ultimate objective of ASAP is to reduce the number of accidents caused by the drinking driver. The purpose of the roadside surveys of randomly selected drivers is to provide a secondary measure of the project's effectiveness in reducing the incidence of driving under the influence of alcohol. The blood alcohol concentrations of drivers in the base-line survey are compared with those during the second survey,

and tentative results suggest poor effectiveness of the counter-measures.

by T. J. Smith  
Virginia Hwy. and Transportation Res. Council  
Publ: HS-016 650, DRIVER PERFORMANCE.  
TRANSPORTATION RESEARCH RECORD 520.  
Washington, D.C., 1974 p38-46  
1974 ; 2refs  
Sponsored by Com. on Traffic Law Enforcement  
Availability: In HS-016 650

HS-016 655

## **FUTURE ROLE OF DRIVER LICENSING IN HIGHWAY SAFETY**

Aspects of driver licensing are discussed in a collection of conference papers. Topics covered include: driver licensing research; philosophy, criteria, and methods of licensing; the effectiveness of driver licensing laws; overview of NHTSA research activities in driver education and licensing; diagnostic tests in driver education; a computer-based system for licensing elderly drivers and others; selection ratios in the future of licensing.

by M. Moore, ed.  
Transportation Res. Board, National Res. Council  
Rept. No. TRB-SR-151 ; 1974 ; 52p 32refs  
Includes HS-016 656--HS-016 662 Presented at the 52d annual meeting of the Hwy. Res. Board  
Availability: Corporate author \$2.20

HS-016 656

## **PHILOSOPHY, CRITERIA, AND METHODS OF DRIVER LICENSING**

The concept of driver licensing is reviewed and groups of persons who require special licensing procedures are identified. They include: persons who are basically unskilled; those who are skilled but inexperienced; those who create demanding situations (e.g., problem drinkers, sociopaths, serious medical impairments); and those who lack spare capacity to respond effectively to demanding driving situations. A scheme for driver licensing is diagrammed for initial and subsequent renewal examinations. The initial test deals with tests in law, vision, basic skill, emergency skill, and medical questions. A renewal test encompasses law and vision tests as well as alcohol and medical questions. The renewal test at age 60 or over includes law and vision tests, senility and medical questions, and possibly skill tests.

by J. A. Waller  
University of Vermont, Dept. of Community Medicine  
Publ: HS-016 655, FUTURE ROLE OF DRIVER  
LICENSING IN HIGHWAY SAFETY, Washington, D.C.,  
1974 p7-14  
1974 ; 1ref  
Availability: In HS-016 655

HS-016 657

## **DRIVER LICENSING LAW: HELP OR HINDRANCE?**

The effectiveness of the driver licensing law is examined in

offered on licensing legislation, suspension and revocation procedures, the point system, and the nature of the law itself. Suggestions are made for improving the system, including discretionary power to the administrator of the licensing function, reductions in licensing involvement with legislation, better communication between the legislature and administrator, and the administrator and the public, and more research to validate practices and procedures.

by V. J. Perini, Jr.  
Highway Users Federation for Safety and Mobility  
Publ: HS-016 655, FUTURE ROLE OF DRIVER  
LICENSING IN HIGHWAY SAFETY, Washington, D.C.,  
1974 p15-8  
1974 ; 1ref  
Availability: In HS-016 655

HS-016 658

## **OVERVIEW OF NHTSA RESEARCH ACTIVITIES IN DRIVER EDUCATION AND LICENSING**

The need for a detailed analysis of the driving task to determine educational program needs and a new set of standards for determining an individual's qualifications to receive a driver's license is discussed. Details are given on: safe performance curriculum for secondary schools; traffic safety education; advanced driver education; motorcycle safety education; commercial truck and bus operator training; adult education; driver education tests; driver knowledge manuals; visual and auditory test requirements; driver background factors; and driving skill.

by J. W. Eberhard  
National Hwy. Traffic Safety Administration  
Publ: HS-016 655, FUTURE ROLE OF DRIVER  
LICENSING IN HIGHWAY SAFETY, Washington, D.C.,  
1974 p22-30  
1974 ; 23refs  
Availability: In HS-016 655

HS-016 659

## **A CASE FOR DIAGNOSTIC TESTS IN DRIVER EDUCATION**

Objective tests of student driving performance are developed which proved sensitive to student levels of driving performance before entering driver education and to changes in performance after driver education. The results of the tests showed that students bring widely varying levels of skills to the driver education program. They also showed that some students need additional training to attain requisite high levels of skill. The performance tests developed in this study can be used as a diagnostic tool to identify student needs. With such a diagnostic approach, programs can be matched to students' needs.

by T. H. Rockwell; N. J. Rackoff  
Ohio State Univ.  
Publ: HS-016 655, FUTURE ROLE OF DRIVER  
LICENSING IN HIGHWAY SAFETY, Washington, D.C.,  
1974 p31-9  
1974 ; 7refs  
Availability: In HS-016 655

## **COMPUTER-BASED SYSTEM FOR LICENSING ELDERLY DRIVERS AND POSSIBLY OTHERS**

The shaky legal basis of driver licensing brings into sharp focus the problem of predictive validity and may soon put states on the defensive in court to justify their tests. A system is proposed which is applicable not only to the elderly driver but also to any problem class of driver, such as the young, those with diagnosed illness or physical impairment, and those with high violation records or recent accidents. The proposal is that certain drivers be submitted, either voluntarily or by court decree, to a multiphase driving examination, not unlike the automated screening devices being implemented in health maintenance organizations. The actual hardware would be computer-based. The system input and output is shown. After basic skills are tested and the subject has completed a simulated driving task, a proficiency measure is computed. Those with high proficiency scores could be issued unconditional licenses. Those with extremely low scores may reappear for retesting later. Those with moderate scores, or certain classes of deficiencies, could be branched into a number of alternatives, including: road test with an examiner; restricted license; or retraining and reexamination.

by E. L. Wiener  
University of Miami  
Publ: HS-016 655, FUTURE ROLE OF DRIVER  
LICENSING IN HIGHWAY SAFETY, Washington, D.C.,  
1974 p40-4  
1974  
Availability: In HS-016 655

HS-016 661

## **THE CHANGING TASK OF DRIVER LICENSING**

The driver licensing purpose is identified as not only the identification and licensing of those drivers who are most likely to be able to operate motor vehicles on public highways but also to provide the unqualified applicant opportunities to meet the minimum requirements for licensure. A more comprehensive evaluation of driver license applicants is needed in which greater use is made of information on the relationships between certain factors and driving performance. Constructive programs should also be developed to deal with special subgroups of drivers so that the applicant who fails to qualify for a license the first time would have the opportunity to participate in remedial activities. The function of monitoring and controlling driver behavior could be extended and young drivers could be introduced into the driving population in a way that decreases their risk of injury or death. Older drivers could be gradually phased out of the driving population. The cost effectiveness of such a program is discussed.

by P. F. Waller  
University of North Carolina, Hwy. Safety Res. Center  
Publ: HS-016 655, FUTURE ROLE OF DRIVER  
LICENSING IN HIGHWAY SAFETY, Washington, D.C.,  
1974 p45-8  
1974  
Availability: In HS-016 655

## **IS THERE A SELECTION RATIO IN THE FUTURE OF LICENSING?**

The selection ratio is one possibility for improved driver selection that tends to reduce the great number of fatalities, injuries, and losses related to accidents that are purely accidental; i.e., they are made up of random distractions, temporary incapacities, frivolous demands, and overly selfish motivations. This selection process does not yet exist, since there has been no likelihood of rejecting a reasonable portion of the applicants and no provisions made for ensuring that drivers remain qualified and appropriately involved in the actual demands of driving in a complex environment.

by R. A. Olsen  
Pennsylvania Transportation and Traffic Safety Center, Rd.  
User Res. Div.  
Publ: HS-016 655, FUTURE ROLE OF DRIVER  
LICENSING IN HIGHWAY SAFETY, Washington, D.C.,  
1974 p49-51  
1974  
Availability: In HS-016 655

HS-016 663

## **YOUNG DRIVER ACCIDENTS. A REPORT PREPARED BY AN OECD ROAD RESEARCH GROUP**

Existing statistics and scientific literature are reviewed and the consistent over-representation of young drivers, 15-24 years of age, in road accidents is highlighted. The extent of this problem in relation to that of the driving population in general, and factors considered to be of important relevance to the problem were determined. These factors are: the risk the young driver runs of being involved in a road accident considered against his experience in driving; the vehicle-related factors, and the high risk connected with the use of high-powered motor-cycles and with the negligent use of safety belts, were pointed out in this connection; the influence of alcohol and drugs was considered within the context of social pressure to which the young driver is exposed, together with the personality and the attitudes of the driver; the possibilities and limitations of selection procedures based on testing were examined, with the role of driver training and licensing; and, methods and findings of accident research were considered as sources of information relevant for devising countermeasures aiming at the reduction of accidents. The comprehensive state-of-the-art ends with a critical review of the well established, probable and sometimes conflicting research evidence available. The report suggests the areas in which accident prevention countermeasures are most likely to prove effective and presents a methodological framework which should be useful in the future.

Organization for Economic Co-Operation and Development  
1975 : 192p 273refs  
Includes HS-016 663 -- HS-016 672  
Availability: OECD Publication, 1750 Pa. Ave., NW,  
Washington, D.C., 20006 \$6.00

HS-016 664

## **YOUNG DRIVERS: THE PROBLEM**

The disproportionately high number of young people (17-24 years) involved in highway accidents is examined. Data are

within each country are reported, showing the extent of the problem. It is noted that all accident categories in which the young age group is over-represented, including traffic, drowning and firearms, involve activities with clear elements of risk taking. Studies of such activities and of how young people become involved in them may provide the key to a better understanding of their accidents and to the solution of the problem. Areas of concern with regard to young drivers are categorized as: exposure and experience; type and state of the vehicle; use of alcohol and drugs; personality; driving skills and training; and features of accidents and methods of data collection and analysis.

by J. Marek; T. Sten

Publ: HS-016 663, YOUNG DRIVER ACCIDENTS. A REPORT PREPARED BY AN OECD ROAD RESEARCH GROUP, Paris, 1975 p11-22  
1975

Availability: In HS-016 663

HS-016 665

### **EXPOSURE AND EXPERIENCE [YOUNG DRIVER ACCIDENTS]**

Exposure and experience are examined as factors in youth driving accidents. Various studies are reviewed and it is concluded that future research efforts should be directed towards determining the degree of accident risk associated with various driving situations and conditions, and towards determining the characteristic driving patterns of drivers of different ages. Such research would permit a comparison of the exposure patterns of young and old drivers, without which firm conclusions on the question of differential accident rates cannot be drawn. Research is also needed on the most effective methods of data collection, such as roadside surveys, interviews and questionnaires, driving diaries, and data from vehicle inspection stations and driver license renewal facilities.

by R. Mills; S. W. Quenault

Publ: HS-016 663, YOUNG DRIVER ACCIDENTS. A REPORT PREPARED BY AN OECD ROAD RESEARCH GROUP, Paris, 1975 p23-44  
1975

Availability: In HS-016 663

HS-016 666

### **TYPE AND CONDITION OF THE VEHICLE**

The vehicle itself is examined as a possible variable affecting the high accident rate of young drivers. The contribution of the vehicle factor to accident causation is reviewed, and a low percentage of the causal factor variance is accounted for by vehicle factors. Consideration is given to type of vehicle, age, power and maintenance of vehicle, safety belt usage, and two-wheeled vehicles. It is shown that certain age groups prefer certain types of vehicles, and there are indications that adolescents more frequently drive vehicles which represent increased risks for the driver since they give less protection. Their vehicles are generally slightly older and tend to be less well maintained. Differences in capacity, horsepower and body style of passenger cars have only little effect on accident involvement rates. The number of traffic violations of young drivers shows a linear increase with time spent on care of the vehicle. Cars of young drivers are found to be significantly less often equipped with safety belts and the belts are used

cycle riders are especially over-represented in accident statistics, with the serious injury and fatality rate per mile up to five times higher than for automobile occupants. It is established that the combination young driver/high-powered motorcycle is the most dangerous one with the highest accident rate.

by K. Hoffner; H. Mori

Publ: HS-016 663, YOUNG DRIVER ACCIDENTS. A REPORT PREPARED BY AN OECD ROAD RESEARCH GROUP, Paris, 1975 p45-62  
1975

Availability: In HS-016 663

HS-016 667

### **ALCOHOL AND DRUGS**

Alcohol and drug use are examined as they affect the high accident rates of young drivers. The classification of drugs is discussed, and patterns of alcohol and drug consumption by young drivers are reviewed. Methodological problems and multiple drug use studies are considered with regard to the effects of drugs on driving. Studies of drugs and driving are reported in several groups of young drivers, including heroin addicts, young criminals, and the general population. Problems associated with marijuana and alcohol in the driver are reviewed, and the difficulties in interpreting various statistics are cited. Studies of drinking patterns and age in relation to accidents are further examined. Countermeasures for young drivers are proposed, such as: limitations on drinking age; alcoholic strength of drinks; location of drinking place; limitations on driving speed; alcohol safety interlock systems; mass media programs; and formal educational programs.

by R. B. Voas

Publ: HS-016 663, YOUNG DRIVER ACCIDENTS. A REPORT PREPARED BY AN OECD ROAD RESEARCH GROUP, Paris, 1975 p63-82  
1975

Availability: In HS-016 663

HS-016 668

### **PERSONALITY AND OTHER PERSON-CENTRED CHARACTERISTICS**

Sociological and psychological aspects of young drivers are examined as they pertain to driver safety. It is found that: low educational level and a history of poor occupational achievement are related to the tendency to seek danger on the road; certain social habits characteristic of youth increase their risk exposure (e.g., night driving and alcohol consumption); social values of young men are oriented toward competition and masculinity; young drivers have the mental, sensory and psychomotor pre-requisites for safe driving; their knowledge of traffic rules is comparatively good; correlations between young drivers' traffic accident and violation behavior and clinical personality test variables are weak; and, the validity and application of the concept of accident proneness is problematic. It is concluded that the use of attitudinal questionnaires and personality tests in selecting drivers seems not to be useful from a licensing point of view, but psychological tests may



by A. Tallqvist; M. J. Maki; J. Prigogine  
Publ: HS-016 663, YOUNG DRIVER ACCIDENTS. A  
REPORT PREPARED BY AN OECD ROAD RESEARCH  
GROUP, Paris, 1975 p83-96  
1975  
Availability: In HS-016 663

HS-016 669

## **DRIVER TRAINING**

There exist no adequate specifications for curricula in driver training. Evaluations of driver training have not provided definite and reliable information on the outcomes of training programs. The most important problems involved in both the development of training programs for drivers and in their evaluation are similar. For either purpose it will be necessary to complete a detailed task analysis, develop specific behavioral objectives, provide reliable measuring instruments, and develop a course of instruction with an optimum content based on aspects of driver skill.

by S. W. Quenault  
Publ: HS-016 663, YOUNG DRIVER ACCIDENTS. A  
REPORT PREPARED BY AN OECD ROAD RESEARCH  
GROUP, Paris, 1975 p97-120  
1975  
Availability: In HS-016 663

HS-016 670

## **ACCIDENT DATA COLLECTION, ANALYSIS AND FINDINGS**

A number of specific sources of both accident and related data are described, along with their applicability to young driver research and relevant findings. Consideration is given to: motor vehicle registration and driver licensing data; national accident summary file; routine police accident reports; insurance accident reports; fatality analysis file; bi-level investigations; in-depth investigations. Implications of the findings of high representation by young drivers in accident statistics are discussed.

by J. Fell; V. J. Esposito  
Publ: HS-016 663, YOUNG DRIVER ACCIDENTS. A  
REPORT PREPARED BY AN OECD ROAD RESEARCH  
GROUP, Paris, 1975 p 121-45  
1975  
Availability: In HS-016 663

HS-016 671

## **CONCLUSIONS, COUNTERMEASURES AND FUTURE RESEARCH [YOUNG DRIVER ACCIDENTS]**

Aspects of the high representation of young drivers in accident statistics as presented in the OECD Road Research Group report, 1975, are concluded. Consideration is given to: traffic accidents of young drivers as a special problem; dimensions of the problem and characteristic factors; extent of the problem as derived from national statistics; the degree of exposure to risk; lack of driving experience; contributing vehicle factors in accidents involving youth; alcohol and drug use; physical and mental predispositions, and social influences; driver training,

tionary licenses; speed limits; and research needs. Research is advocated on driver training methods, the effects of licensing type controls, conditions under which different driver age groups are exposed to traffic, youth behavior, driving errors and types of young driver accidents, and patterns of driving habits of young drivers.

Publ: HS-016 663, YOUNG DRIVER ACCIDENTS. A  
REPORT PREPARED BY AN OECD ROAD RESEARCH  
GROUP, Paris 1975 p 147-53  
1975  
Availability: In HS-016 663

HS-016 672

## **YOUNG DRIVER ACCIDENTS. APPENDICES.**

Appendices related to young driver accidents are presented on: age limits for young drivers; patterns of alcohol and drug consumption by young drivers; and possible countermeasures against drinking and driving by young drivers. Extensive references are included.

Publ: HS-016 663, YOUNG DRIVER ACCIDENTS. A  
REPORT PREPARED BY AN OECD ROAD RESEARCH  
GROUP, Paris, 1975 p156-68

Availability: In HS-016 663

HS-016 673

## **DEATH OFTEN RIDES AT THE WHEEL OF THE DROWSY DRIVER**

Drowsiness as a cause of accidents is discussed and the general impact of driver fatigue is examined. Research studies are reviewed which suggest new ideas for combatting drowsiness, including the use of a driving simulator to monitor reactions to near-collision problems. The results indicate that 50% of those drivers who admitted having occasional tendency to drowsiness while driving were accident prone. Factors other than fatigue are identified: self-hypnosis induced by sun glare and driving monotony, low blood sugar, or age. The effects of various drugs, including common remedies for overweight, high blood pressure, nervousness, hayfever, or colds, or pain-killers, are also discussed. Special studies of narcolepsy are reported, and specific precautions against drowsiness are listed.

by W. L. Roper  
Publ: CALIFORNIA HIGHWAY PATROLMAN p5, 24-5, 28-9, 32-3 (Oct 1973)  
1973  
Availability: See publication

HS-016 674

## **THE HAMPSHIRE CHILD PEDESTRIAN ACCIDENT STUDY**

Accidents involving child pedestrians carried out in 1972 in conjunction with the Hampshire Constabulary are studied. More detailed information about accident situations is provided than is normally available through standard reporting procedures. The data covers such items as journey purpose,

distance from home, and accompaniment. The reports of the children indicated that in the great majority of cases lack of attention prior to crossing was associated with the accident situation. Inadequate supervision contributed to accidents involving young children.

by G. B. Grayson  
Transport and Road Research Laboratory, Safety Dept.,  
Crowthorne, Berks, 1975 (England)  
Rept. No. TRRL-LR-668 ; 1975 ; 16p  
Availability: Road User Characteristics Div., Safety Dept.,  
Transport and Rd. Res. Lab., Crowthorne, Berks., England

HS-016 675

### EFFECTS OF TIRE ROLLING RESISTANCE ON VEHICLE FUEL CONSUMPTION

Since variation in the effects of tire rolling resistance on passenger car fuel consumption seldom exceeds 10%, the definition of these effects is a problem in experimental design and control, measurement precision, and careful accounting for uncontrolled variables. A rolling resistance test conducted on a road surface with a fully instrumented tire test trailer is described and the test results presented. Fuel economy test techniques are discussed with emphasis on precautions and recommendations for reliable testing and test results. When aerodynamic drag is taken into account with wind tunnel measurements, the results are suggestive of engine characteristic curves.

by W. B. Crum; R. G. McNall  
Ford Motor Co., Dearborn, Mich. 48121  
Publ: TIRE SCIENCE AND TECHNOLOGY v3 n1 p3-15  
(Feb 1975)  
1975 ; 4refs  
Presented at the American Society for Testing and Materials  
Committee F-9 on Tires Symposium and Fuel Economy,  
Dearborn, Mich., 8 May 1974.  
Availability: See publication

HS-016 676

### NONLINEAR WAVE PROPAGATION IN VISCOELASTIC TUBES: APPLICATION TO AORTIC RUPTURE

Traumatic rupture of the aorta followed by immediate exsanguination as a cause of a significant percentage of traffic deaths in the U.S. is discussed. A mathematical analysis is presented of the motion of blood in a distensible viscoelastic segment of aorta subjected to a decelerative force field. Calculations of axial wall strain and strain-rate indicate that wave propagation resulting in abrupt shock-like transitions along the aortic wall may well account for the transverse ruptures observed, when compared with the limited amount of rupture data presently available. The analytic method and numerical solution by a two-step Lax-Wendroff differencing scheme are sufficiently general to describe a wide variety of initial and boundary conditions related to blunt impact to the thorax.

by Y. Kivity; R. Collins  
University of California, Los Angeles, Calif.  
Publ: JOURNAL OF BIOMECHANICS v7 p67-76 (1974)  
1974 ; 26refs

HS-016 677

### A MODEL ANALYSIS OF THE STRUCTURAL AND PNEUMATIC CONTRIBUTIONS TO TIRE BEHAVIOR UNDER VERTICAL LOADS

An inflated ring under compression between rigid, flat, parallel plates is used to provide a simple analysis for the structural and pneumatic contributions to the behavior of tires under vertical loading. The fundamental assumption is the additivity of the solutions for the limiting cases of pure bending and of pure membrane behavior, for which exact solutions in simple form are given. Bounding curves for contact width and pressure changes are given as functions of deflection. The computed force-deflection relations exhibit linearity up to a high deflection.

by D. W. Nicholson  
The Goodyear Tire and Rubber Co., Akron, Ohio 44316  
Publ: TIRE SCIENCE AND TECHNOLOGY v3 n1 p29-42  
(Feb 1975)  
1975 ; 7refs  
Availability: See publication

HS-016 678

### CONTACT OF AN INFLATED TOROIDAL MEMBRANE WITH A FLAT SURFACE AS AN APPROACH TO THE TIRE DEFLECTION PROBLEM

A finite element procedure is described which is developed for the displacement and stress analysis of a homogeneous and isotropic inner tube mounted on a rim and in contact with a flat surface. The geometric nonlinear effect is accounted for by including the quadratic terms in the strain-displacement equations. The non-linear load-displacement path is predicted by a linear incremental procedure. The procedure is first demonstrated by a large deflection analysis of a strip of a tire. The results are in good agreement with a known alternative solution. A homogeneous and isotropic inner tube is then pressurized and the displacements and stresses are found. The displacements are also found experimentally. Both results are in good agreement. The inner tube is mounted on a rim and pressed against a rigid flat surface. The resulting displacements and footprints are also measured experimentally. The computer results are shown to be in reasonable agreement with the experiment.

by J. DeEskinazi; W. Soedel; T. Y. Yang  
Ray W. Herrick Labs., Purdue Univ., W. Lafayette, Ind.  
47906  
Publ: TIRE SCIENCE AND TECHNOLOGY v3 n1 p43-61  
(Feb 1975)  
1975 ; 8refs  
Availability: See publication

HS-016 679

### DEREGULATION: THE MOTOR CARRIER DESTRUCTION ACT OF 1975?

The for-hire trucker atmosphere is described with regard to the Motor Carrier Improvement Act of 1975, which is critically evaluated, along with the Justice Department's plan to deregulate

the commodities they can carry, where they can go, and whom they're obligated to serve. The deregulation plan is criticized point by point, and it is concluded that the most irritating, harmful points are the granting of new operating certificates without proof of necessity, the hampering of protests on independent action, the ruination of airfreight motor carrier certification, and the granting of federal highway funds to aid the railroad system. Lobbying by truckers is advocated to support the industry.

by B. Swart

Publ: FLEET OWNER p51-6 (Apr 1975)

1975

Availability: See publication

HS-016 680

### **THINKING TWICE ABOUT HIGHWAY SAFETY. [WISCONSIN] GOVERNOR'S CONFERENCE ON HIGHWAY SAFETY IMPROVEMENT**

Two of the most important safety challenges are discussed: how to discourage drunken driving, and how to encourage safety belt usage. Conference participants examined various other aspects of highway safety, including: driver and pedestrian safety, an overview of highway safety needs; labor's interest in off-the-job safety; national and state cooperation; county and city roles; industry's role; motorcycle safety; Wisconsin's Friend in the Sky program; and outlook for the future.

1974 ; 62p

Report of Conference held 27-8 Jun 1974, Madison, Wis.

Availability: Division of Hwy. Safety, Madison, Wis.

HS-016 681

### **LAP BELTS AND 3-POINT BELTS: A COMPARISON OF EFFECTIVENESS**

The results of the Institute for Road Safety Research SWOV accident investigation prove that if there is any difference in the effectiveness of lap and 3-point belts, it is very small and cannot form a basis for giving preference for one type above the other. Results of investigations carried out in foreign countries prove that the effectiveness results obtained for both lap belts and 3-point belts, are very high, and show a satisfactory correlation with the results of the SWOV investigation, although there are some differences in classification, and differences in traffic situations and car population, which prevent exact comparisons. From this it is justified to draw the conclusion that the use of both the lap belt and the 3-point belt are highly valuable measures for promoting safety in traffic. However, the possibility that the anchorage points of seat belts cannot be provided at the same place in each type of passenger car must be considered, giving credence to the conclusion that lap belts are valuable measures for promoting safety under any circumstances, while 3-point retractor belts do not always ensure adequate safety.

by L. T. B. van Kampen; A. Edelman

Institute for Road Safety Research SWOV. Crash and Post-

crash Dept., Voorburg

1975 ; 30p 15refs

Availability: Availability

HS-016 682

### **AN AID ANALYSIS OF TEXAS TRAFFIC ACCIDENT DATA BEFORE AND DURING THE ENERGY CRISIS.**

Fatal accident data from Texas for two six-month periods (one before and one during the energy crisis) have been analyzed using the Automatic Interaction Detector (AID) computer algorithm. This method identifies those factors which account for the greatest difference in fatal accident involvement between the two periods. Overall, there was a reduction in fatal accident involvements of 23% in the first six months of 1974 as compared with the same period of 1973; a corresponding reduction of 11.7% was observed in all traffic accident involvements. The difference between these two percentages is attributed largely to the effects of speed reduction. In support of this observation, it is noted that the severity of crashes occurring in the crisis period decreased, as measured by the traffic accident data severity scale. Severe crashes diminished in frequency by 18% and 24% respectively, as compared with a 12% reduction for crashes of the least severity. Detailed breakdowns of the accident characteristics for two periods are compared.

by D. H. Golomb; J. O'Day

Contract DOT-HS-4-00937

Publ: HIT LAB REPORTS v5 n7 p1-9 (Mar 1975)

1975

Availability: See publication

HS-016 683

### **EVOLUTION OF A NEW COMBUSTION SYSTEM FOR DIESEL EMISSION CONTROL**

Efforts to improve the emission control problems of small, naturally aspirated diesels are discussed. The exhaust quality of engines of this type can be improved by reducing the combustion temperatures and/or reducing the initial heat release rate: a range of methods of achieving this are examined and found commercially unacceptable. A qualitative review of the problem led to the evolution of a modified cycle characterized by high turbulence leading to higher air/fuel mixing rates and faster diffusion burning. This Squish Lip combustion system allowed the California Air Resources Board (CARB) projected 1977 emission levels to be met on developmental engines without performance deterioration. Bench and field trials are in hand and a second generation system for truck applications is being evaluated.

by R. Bertodo; T. W. E. Downes; I. D. Middlemiss

Perkins, Engs. Co., England

Rept. No. SAE-741131 ; 1974 ; 12p 6refs

Presented at Truck Meeting, Troy, Mich., 4-7 Nov 1974

Availability: SAE

HS-016 684

### **A CASE FOR STANDARDIZATION [TRUCK WIRING]**

Several specifications for heavy-duty truck wiring, especially wire and harness assemblies, and low-tension electrical wire are outlined. Emphasis is on avoidance of substandard wiring and components, identification of circuits, grounding

techniques, and construction. It is noted that improved specifications will result in reduced maintenance costs.

by C. J. Owen; G. F. Cantlay  
Whitaker Cable Corp; Western Gillette, Inc.  
Rept. No. SAE-741143; 1974; 14p  
Presented at Truck Meeting, Troy, Mich., 4-7 Nov 1974  
Availability: SAE

HS-016 685

# **SINGLE-CYLINDER STUDY OF STRATIFIED CHARGE PROCESS WITH PRECHAMBER-INJECTION**

The behavior of the stratified charge engine with prechamber injection is examined in an experimental investigation of several important parameters. Special attention is given to degree of charge stratification, position of injection nozzle and spark plug in the prechamber, construction of the injection nozzle, start of injection, timing of ignition, and throttling of the intake air. These parameters have a more or less significant influence on output, fuel consumption, and exhaust emission. The combustion system was adjusted partly by optimizing and partly by compromising. Comparison with a conventional spark ignition engine is made. Using a mathematical model of the process, the possible causes of the significant improvements in nitrogen oxide emissions are discussed.

by F. F. Pischinger; K. J. Klocker  
Lehrstuhl für Angewandte Thermodynamik an der Rheinisch-Westfälischen Technischen Hochschule Aachen  
Rept. No. SAE-741162; 1974; 15p 25refs  
Presented at International Stratified Charge Engine Conference, Troy, Mich., 30 Oct - 1 Nov 1974  
Availability: SAE

HS-016 686

# **COMBUSTION CHARACTERISTICS OF THE TORCH IGNITED ENGINE**

Experimental work of the torch ignited engine demonstrated that this engine provided stable engine performance and low exhaust emissions using an overall lean mixture. Some combustion characteristics of the torch ignited engine were compared with those of a conventional one. Experimental analysis was performed to determine the influence of a number of prechamber inlet air-fuel ratios and nozzle diameters. These are respectively a main operating factor and a main design factor of the torch ignited engine. These factors control the torch combustion process and determine engine performance and emissions characteristics.

by Y. Sakai; K. Kunii; S. Tsutsumi; Y. Nakagawa  
Nissan Motor Co., Ltd., Japan  
Rept. No. SAE-741167; 1974; 10p 7refs  
Presented at International Stratified Charge Engine Conference, Troy, Mich., 30 Oct - 1 Nov 1974  
Availability: SAE

HS-016 687

# **VOLUME AND TEMPERATURE INFLUENCES ON THE EFFECTIVENESS OF LEAN THERMAL REACTORS**

Work done to separate and further define the effects of volume and temperature on the effectiveness of exhaust thermal reactors operating at lean air/fuel ratios is described. Thirty feet of stainless tubing with a volume of over 1200 cubic in. was added to the exhaust manifold of a four cylinder engine. The entire assembly was insulated to serve as a constant temperature lean reactor. Exhaust emission and temperature measurements at various points along the reactor provided data on the extent of the hydrocarbon (HC) and carbon monoxide (CO) oxidation reactions as a function of reactor volume. Mass flow calculations were made to calculate exhaust gas residence time. The data are presented as percent HC and CO reacted versus gas residence time in the reactor and are plotted to show the effect of reactor temperatures ranging from 1275°F to 1675°F at various inlet HC concentrations. Limited data are also presented on the effect of exhaust flow rate on mixing.

by J. E. Lahiff; W. C. Albertson  
General Motors Corp.  
Rept. No. SAE-741168; 1974; 12p  
Presented at International Stratified Charge Engine Conference, Troy, Mich., 30 Oct - 1 Nov 1974  
Availability: SAE

HS-016 688

# **A TWO-CHARGE ENGINE CONCEPT: HYDROGEN ENRICHMENT**

The first engine dynamometer test results are presented for a modified fuel system based on hydrogen enrichment for a V-8 internal combustion engine. The engine burns mixtures of gasoline and hydrogen under ultralean conditions to yield extremely low nitrogen oxide emissions with increased engine efficiency. The hydrogen is produced in a compact onboard generator from gasoline and air. The hydrogen-rich product gas is cooled and mixed with the normal combustion air in a modified carburetor. The engine then operates in a conventional manner on atomized gasoline with spark ignition, but with hydrogen-enriched air and with a high spark advance of 40-50 degrees BTDC. The engine thus receives a charge of gaseous fuel from the hydrogen generator, and the normal gasoline charge. The results on hydrogen enrichment are compared with the 1973 V-8 baseline stock engine with emission controls, and the same engine without controls and operated at maximum efficiency under lean conditions. All results are compared at level road load as a function of rpm. Relative to the stock 1973 350 CID engine, an approximate 10% reduction in brake specific fuel consumption was measured over the entire level road load speed range, and nitrogen oxide emissions were reduced to below the equivalent 1977 EPA standards. Further effort is required to reduce the hydrocarbon and carbon monoxide emissions to an equivalent level. The hydrogen enrichment concept is compared with a pre-chamber stratified charge engine. The analogy is made that if the pre-chambers

for each cylinder were combined into a single pre-combustor, it shows some similarities to the hydrogen generator.

by J. Houseman; F. W. Hoehn  
California Inst. of Technology, Jet Propulsion Lab.  
Rept. No. SAE-741169; 1974; 15p 6refs  
Presented at International Stratified Charge Engine  
Conference, Troy, Mich., 30 Oct - 1 Nov 1974  
Availability: SAE

HS-016 689

### **THE ROLL OF CONNECTING NOZZLE AND THE FLAME INITIATION POINT IN THE PERFORMANCE OF A DUAL CHAMBER STRATIFIED CHARGE ENGINE**

Experimental work is carried out to investigate the importance of the connecting nozzle between the auxiliary and the main chambers, and the ignition point location to the performance of a stratified charge spark ignition engine using Broderson's method of charge stratification. Three different nozzle configurations and two ignition point locations were used. It is shown that the fuel economy obtained with this approach is dependent upon the nozzle geometry which also plays an important role in the combustion noise generation, a characteristic of this method. The results show good fuel consumption over the entire range; the analytical work on the combustion of the mixture in the auxiliary chamber indicates that the flame initiation near the center of the nozzle opening has a potential of restricting the flow of unburned mixture in the main chamber.

by K. S. Varde; M. J. Lubin  
University of Rochester, Dept. of Mechanical and Aerospace Sciences  
Rept. No. SAE-741161; 1974; 10p 22refs  
Presented at International Stratified Charge Engine  
Conference, Troy, Mich., 30 Oct - 1 Nov 1974  
Availability: SAE

HS-016 690

### **FLAME PROPAGATION IN AN EDDY COMBUSTION CHAMBER**

Combustion in a model eddy combustion chamber was studied in order to gain insight into the combustion mechanism. High-speed schlieren cinematography and recording of the ionization current were used. It was established that the flame kernel formed by ignition at the periphery stretches to the rotation axis, and at a high enough acceleration, the flame blows off the drop, the burning slopes up, and combustion products rush to the rotation axis. After reaching the rotation axis, the kernel acquires the form of rotating body. The radial spread of this body can be lower than the visible rate of the immobile gas burning, due to the fast elongation of the rotating body along the axis. The results obtained are essential for understanding the phenomena occurring in eddy chambers of diesel engines and engines with spark ignition at an eddy motion.

by A. D. Margolin; V. P. Karpov  
Academy of Sciences (U.S.S.R.)  
Rept. No. SAE-741165; 1974; 5p 2refs  
Presented at International Stratified Engine Conference, Troy, Mich., 30 Oct - 1 Nov 1974

HS-016 691

### **DESIGN AND OPERATION OF EUROPEAN TRUCKS FOR MAXIMUM FUEL ECONOMY**

Composition of the United States and Canadian commercial vehicle industry differs considerably from that of Western Europe, especially in the relative importance of certain weight categories and the overwhelming emphasis placed on gasoline engines in all but the heaviest vehicles. An analysis of representative European and United States commercial vehicles and trucks indicates that more horsepower is applied per ton gv in the United States than in Europe, thus the need for more gasoline and diesel fuel in the U.S. Governmental tax policies which can constitute economic restrictions as well as the availability of petroleum fuel are important contributing factors to vehicle design and operation. These, combined with specific environmental requirements, not only for domestic service but also for export areas, have a direct bearing on the character of a successful commercial vehicle program. Changing political, economic, and ecological conditions, as well as the long-term outlook regarding petroleum fuel supplies, and design of present vehicles, makes it necessary to reassess the definition of the current commercial vehicles.

by A. Arabia  
General Motors Overseas Operations  
Rept. No. SAE-741128; 1974; 8p  
Presented at Truck Meeting, Troy, Mich., 4-7 Nov 1974  
Availability: SAE

HS-016 692

### **THE ROLE OF VEHICLE HANDLING IN ACCIDENT CAUSATION**

The relation between vehicle handling and accident frequency is examined with emphasis on evaluating the role of the vehicle rather than the man-car combination. It is shown that over 80% of loss of control accidents involve single vehicles only, so the single vehicle accident rate can be used as a measure of proneness of loss of control. Single vehicle accident rates are determined by model of car, and the effect on these rates of other factors, such as variations in driver age and ratio of male to female driver population between the different models, is assessed. Multiple regression techniques are used to establish the relative importance of handling response parameters when compared to driver effects and also to decide which are the most appropriate parameters to consider. The results show that in explaining the variation in the accident rate between different models of car, driver effects account for up to 70%; if driver effects are removed from the accident rate then handling parameters explain about 35-40% of the remaining variation between models of car. The important parameters appear to be weight, a measure of the change in understeer as a function of lateral acceleration, and power to weight ratio.

by I. S. Jones  
Calspan Corp.  
Rept. No. SAE-750115; 1975; 23p 15refs  
Presented at Automotive Engineering Congress and  
Exposition, Detroit, Mich., 24-28 Feb 1975  
Availability: SAE

HS-016 693

HS-016 693

### **AN OBJECTIVE ANALYSIS OF THE PROTECTION OFFERED BY ACTIVE AND PASSIVE RESTRAINT SYSTEMS**

Current comparisons between active and passive restraint systems are still subjective and emotional. Statistical data, accident surveys, theoretical studies, and crash test results allow a technical analysis. Consideration of performances obtained during impact tests with various types of restraint systems; comparative performances of belts and air bags evaluated by simulation of frontal collisions using volunteers; performances of belts evaluated by reconstruction of actual accidents with dummies; performance of 3-point seat belts in actual accidents; technical aspects of all these; comfort of the restraint system; and, economics helps to form an objective opinion. Conclusion is that the different principles of restraints are not opposed, but appear as successive steps of a same evolution.

by P. Ventre; J. C. Rullier; C. Tariere; F. Hartemann; A. Fayon  
Regie Nationale des Usines Renault; Association Peugeot-Renault  
Rept. No. SAE-750393 ; 1975 ; 24p 4refs  
Presented at Automotive Engineering Congress and Exposition, Detroit, Mich., 24-8 Feb 1975  
Availability: SAE

HS-016 694

### **CAB CONDITION -- HEATING AND COOLING-- HEAVY DUTY TRUCK AND OFF-HIGHWAY EQUIPMENT**

The demand for year round comfort systems in heavy duty trucks and off-highway equipment is fast approaching that of the passenger car. This trend is leading toward adaption of combination units wherein heater and evaporator are encased in a common assembly with air directional capabilities for either operating mode. It offers the further potential of the re-heat cycle as a temperature modulation means during air conditioning operation. Heating principles are conventional in nature, utilizing engine coolant as the heat source. Cooling, while following basic automotive concepts, is more complex, particularly with respect to condenser placement and air filtration. Performance sufficient to warrant customer satisfaction is a requirement. Durability, strength of materials and operating life of functional components is a more critical criterion.

by F. W. Fisher  
Eaton Corp., Climate Control Div.  
Rept. No. SAE-750400 ; 1975 ; 4p 1ref  
Prepared for Automotive Engineering Congress and Exposition, Detroit, Mich., 24-8 Feb 1975  
Availability: SAE

HS-016 695

### **AGENDA FOR NATIONAL COMMITTEE MEETING (ON UNIFORM TRAFFIC LAWS AND ORDINANCES)**

This agenda is for use by the National Committee on Uniform

HSL 75-10

ternates of the National Committee. At sessions open to public attendance and comment, each subcommittee considers the proposals and makes recommendations to the full National Committee. This document contains the recommendations of five subcommittees which met during 1974 and 1975 following the format of prior agendas used by the National Committee in 1968 and 1971. Changes which are recommended and changes which are not recommended are presented for discussion. These cover motor vehicles, motorcycles and bicycles; driver and vehicle licensing; traffic control and traffic devices; vehicle lighting; accident reports, etc.

National Com. on Uniform Traffic Laws and Ordinances, 1776 Mass. Ave., N.W., Washington, D.C. 20036  
1975 ; 408p  
Availability: Corporate author

HS-016 696

### **PERSONALITY AND TEMPERAMENT DIFFERENCES BETWEEN ALCOHOLICS WITH HIGH AND LOW RECORDS OF TRAFFIC ACCIDENTS AND VIOLATIONS**

This study investigated differences in personality and temperament between alcoholics with a high record of accidents and violations and those with a low record, regardless of whether the accidents and violations were alcoholic related. Two groups of fifty subjects each, similar in age and education were studied. One group (LAV) had low violation records and the other (HAV) had high violation records. The Minnesota Multiphasic Personality Inventory (MMPI) and the Guilford-Zimmerman Temperament Survey (GZTS) were administered to all participants as part of a routine test battery. The HAV group demonstrated greater tendencies to dominate, manipulate and to control others, and to develop unrealistic life goals. They also displayed greater tendencies toward impulsivity, recklessness and irresponsibility. The LAV group were predominantly submissive, seeking comfort in group identification as well as cautiousness and seriousness with somewhat greater concern for responsibility and the image they project. The differences suggest contrasting modes of behavioral expression. Test deviation scores indicate the HAV group had high energy levels and an externally oriented mode of expression with considerable potential for acting out conflicts. The LAV group had lower energy levels and a tendency toward internalization of conflicts and a somewhat over controlled mode of expression. It was concluded that the HAV group type of alcoholics contribute more to highway fatality statistics than other alcoholics. They also share common personality characteristics with non-alcoholics who have been identified as high accident drivers.

by G. J. Mozdierz; F. J. Macchitelli; T. W. Planek; T. J. Lottman  
Edward Hine Jr., VA Hospital, Hines, Ill.; National Safety Council Chicago, Ill.; Loyola Univ. of Chicago.  
Publ: JOURNAL OF STUDIES ON ALCOHOL v36 n3 p395-9 (Mar 1975)  
1975 ; 9refs  
Availability: See publication

## FRONT WHEEL DRIVE IN AMERICA

Front wheel drive (FWD) as applied to large American V-8 powered cars which present additional design considerations is discussed. The use of a large-displacement V-8 engine limits the designer's freedom in the arrangement of the power train components. Problems arise with weight distribution and structural overhang. Power train mounting requirements become different and arrangement of the power train presents additional noise isolation problems. Universal joints, baffles, air deflectors, traction, brakes, steering wheels, tires and body construction are all parts which are affected. One of the principal advantages of the full sized FWD vehicle is its potential from the standpoint of overall vehicle architecture. The absence of the cumbersome prop shaft makes the FWD vehicle configuration ideal for ambulance, station wagon and motor home application. The length of the vehicle is not limited by driveline considerations. The flat floor provides increased seating comfort and the vehicle can be lowered for better passenger access and lower center of gravity, while the larger engine can provide plenty of power for the increased weight of the extended vehicle.

Publ: AUTOMOTIVE ENGINEERING v83 n5 (May 1975)  
1975; 6p 1ref  
Availability: See publication

HS-016 698

## POSITIVE GUIDANCE IN TRAFFIC CONTROL

Positive guidance is based on the premise that a driver can be given sufficient information about a hazard where he needs it and in a form he can use to enable him to avoid an accident. This concept involves an analysis of the information needed by the driver to perform the driving task safely and efficiently. It includes determination of needed information, appropriate traffic control devices, their location and the format of the information presented. The purpose of this report is to show what positive guidance is and how it works. It is designed to tell the engineer what he should do to improve the information system at hazardous locations. Part two is a procedure for applying positive guidance in six major functions: Data collection at problem locations, specification of problems, definition of driver performance factors, definition of information requirements, determination of positive guidance information and evaluation.

by G. J. Alexander; H. Lunenfeld  
Federal Hwy. Administration, Office of Traffic Operations  
1975; 57p refs  
Availability: GPO \$0.85 Stock No. 050-001-00094

HS-016 699

## A SAMPLING PROGRAM FOR EVALUATION OF THE 1974 RESTRAINT SYSTEMS

This progress report is about a precise sampling method of acquiring crash reports about the expected change in injury probability for persons protected by the 1974 interlock systems. The objective is to measure the reduction in the incidence of severe injuries among front seat occupants of 1974 American passenger cars compared with 1973 cars. Sampling techniques using a stratified systematic sample are used to

compare the data experience in 1973 and 1974 passenger cars. The data acquired in the field was computerized. Preliminary findings indicate that more outboard occupants used restraints in the 1974 cars than in the 1973 cars. Current data in the file indicate an injury reduction for 1974 restraint systems of 7.5 percent.

by R. E. Scott; J. O'Day  
University of Michigan, Hwy. Safety Res. Inst., Huron  
Parkway & Baxter Road, Ann Arbor, Mich. 48105  
Publ: HIT LAB REPORTS -- APRIL 1975 v5 n8 (Apr 1975)  
1975; 9p 6refs  
Availability: Corporate author

HS-016 700

## AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF WHEEL SPIN-DOWN AND OTHER VARIABLES. FINAL REPORT

A study of the wet weather characteristics of five different pavements and ten different tires is presented. The pavements studied were a portland cement concrete, a seal coat surface treatment, a hot mix asphalt, a jennite surface and a longitudinally grooved portland cement concrete. The tires studied were several bias ply tires with different tread depths, a wide tire with full tread, a test standard tire, a smooth fiberglass belted tire and a full tread steel belted radial. In this study, wheel spin-down was used as the criterion for the detection of hydroplaning and the variables considered were tire tread depth, tire inflation pressure, water depth and wheel load. A sloping trough 800 feet long, 30 inches wide and 4 inches deep was used in obtaining the data. The results indicate that the seal coat surface treatment requires a considerably higher ground speed to cause spin-down than do the other pavements tested. It was also observed that no single critical speed, necessary for wheel spin-down to occur, exists for the range of variables selected, but it is recommended that there be a reduction of speed to 50 mph for any section of highway on which water can accumulate to 0.1 inch or more during wet weather periods.

by A. J. Stocker; J. T. Dotson; D. L. Ivey  
Texas A and M University, Texas Transportation Inst.,  
College Station, Texas 77843  
Rept. No. TTI-2-10-70-147-3F; 1974; 116p 54refs  
Report for Sep 1969-Aug 1974 research performed in  
cooperation with Federal Hwy. Administration. Research  
Study Title: "Variables Associated with Hydroplaning."  
Availability: Corporate author

HS-016 701

## EMERGENCY SERVICES. WHAT POTENTIAL FOR HELICOPTERS IN EMS?

The success of the military's emergency helicopter-ambulance system led to civilian experiments with them. Under the Department of Transportation (DOT) various states participated in seven projects to test other equipment and concepts in addition to helicopters and air evacuation. Computer applications, communications systems and techniques for training ambulance crews were also studied. Both piston- and turbine-powered helicopters were used. An urban project in Detroit concluded that the increased cost could not be justified in view of the minimal time saved. A rural project in Arizona concluded that its system significantly reduced the time otherwise required to reach the accident scenes and to transport

victims to hospitals. The demonstration projects concluded unanimously that the helicopter could serve rural populations for emergency ambulance service as well as it served the military. High costs could be offset through multi-purpose usage of the helicopters. The more expensive turbine-powered helicopters proved advantageous in colder regions where piston-powered helicopters required lengthy warm-ups. Considerations for using helicopters as ambulances are cost of equipment, size of landing area required, and the speed advantage of the helicopter. Use of the helicopter as an emergency ambulance requires a well organized two-way radio communications system, thoroughly trained technicians, properly equipped and competently staffed backup hospital emergency facilities and categorization of those facilities. Some discussion of an experimental project by Military Assistance to Safety and Traffic was included.

by M. Flexer

Publ: HOSPITALS, JOURNAL OF THE AMERICAN HOSPITAL ASSOCIATION v49 n4 p60-3 (16 Feb 1975) 1975 ; 3refs

Availability: See publication

HS-016 702

# **PROGRESS IN THE IMPLEMENTATION OF MOTOR VEHICLE EMISSION STANDARDS THROUGH JUNE 1974. REPORT TO CONGRESS**

Details of implementing the motor vehicle emission standards are presented in this progress report. The Environmental Protection Agency (EPA) suspended the 1976 motor vehicle emission standards for one year, but proposed or promulgated standards setting emission levels in different vehicle categories and proposed regulations to ensure that motor vehicles meet emission standards. In other areas EPA also developed fuel regulations requiring marketing of lead free fuels, established a schedule for phasing down lead content in fuels, and proposed regulations for registration of fuels and fuel additives; continued its Alternative Power Systems program; initiated contractor studies to assess the technical and economic feasibility of alternative fuels; continued to support research on the technological feasibility and cost of meeting various NOx standards; continued research in assessing the costs and benefits of motor vehicle emission control; continued its certification program; published fuel consumption results on 1974 model year vehicles; expanded inspection program of manufacturing facilities to ensure that certification procedures are observed; developed a new program to test motor vehicles or motor engines in the assembly line; investigated potential violations of tampering with emission controls; tested vehicles in use for air pollution emissions; and, completed a report on emission testing of light-duty vehicles.

Environmental Protection Agency, 4th and M St., S.W., Washington, D.C. 20460  
Rept. No. EPA 230/3-74-013 ; 1975 ; 108p 18refs  
Availability: GPO

HS-016 703

# **FAKTORER SOM MEDVERKAR TILL LAG**

## **(FACTORS CONTRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)**

Conclusions of an analysis of the results of various friction measurements in order to identify factors which can cause low friction between tire and road surfaces are presented. Friction is dependent on the macro- and micro-texture of the road surface. A rough harsh pavement has high and even friction. A smooth, glossy pavement has lower friction. A smooth, glossy, harsh pavement can have good friction characteristics in cold or slightly humid conditions, while heavy rain or local water layers may reduce braking efficiency. A very smooth and glossy pavement has low friction under damp and wet conditions. Friction is dependent on speed. Speed dependence on pavements with smooth texture is greater than on pavements with rough texture. High and even friction is the ideal, and friction characteristics should not vary greatly with time. Hazardous sudden friction changes may arise under some weather conditions if extreme differences in heat capacity occur along the road. Loose sand on a hard firm road surface leads to reduction of friction.

by B. Lilja; E. Ohlsson

National Swedish Road and Traffic Res. Inst., Stockholm, Sweden

Rept. No. R-52 ; 1974 ; 18p

Text in Swedish. Includes English summary

Availability: Corporate author

HS-016 704

## **THE CASE FOR SAFETY WITH STUDDED TIRES**

The advantages of studded tires on a vehicle when traveling on icy roads are discussed. Progress by the tire stud industry in designing and manufacturing studs that cause less road wear is a fact. Tire studs are an aid to winter driving safety that is well worth a minimal addition to road wear as, with or without studded tires, no highway lasts forever. There is considerable evidence that denying motorists the added safety of studded tires will not forestall the need for resurfacing a highway. Painted lines, rutting and hydroplaning, salt, sand and chain use are discussed. The design of the controlled protrusion stud is presented.

Kennametal, Inc., Latrobe, Pa. 15650

1975? ; 24p

Availability: Corporate author

HS-016 705

## **THE CASE FOR SAFETY WITH STUDDED TIRES. PT. 2. SUPPORT DATA**

Legislation in favor of the use of studded tires as related to safety is explored. Some political jurisdictions maintain that studded snow tires increase road wear by as much as 100-150 percent. Other factors such as chemical de-icers also contribute to road wear. Accidents attributed to slippery road conditions and sliding involved fewer studded tire vehicles than suggesting that studded tire vehicles frequently perform better on adverse road conditions than do regular tires. Several tests



and supported by data from companies which have conducted these tests.

Kennametal, Inc., Latrobe, Pa. 15650  
1975? ; 96p 9refs  
Availability: Corporate author

HS-016 706

## **EVALUATION OF TIRE ABRASION IN TERMS OF DRIVING SEVERITY**

This study is an attempt to establish which test conditions best reproduce the relative ratios of tire wear rate which exist between the different types of tires to be found in the field. Three fundamental parameters are defined which characterize the type of wear: specific wear rate, profile shape, and ratio of wear rates between the front and rear axles. The research is developed in three phases: an examination of the various modes of wear present in actual usage, abrasion tests carried out with great precision and at various levels of acceleration severity, and the correlation between the market wear spectra and the test data. The paper concludes that the ratio of wear rates existing between any two types of tire is not generally constant, but it changes in function of the driving severity, thus explaining the disagreement sometimes found when comparing tests made at different centres. The appendix contains a survey made about the problem of the result consistency, including checks in the preparation of tests, definition and execution of the tests and the validity of the results.

by A. Chiesa; G. Ghilardi  
Industrie Pirelli S.p.A., Milan, Italy  
Rept. No. SAE-750459 ; 1975 ; 23p  
Presented at Automotive Engineering Congress and  
Exposition, Detroit, Mich. 24-8 Feb 1975.  
Availability: SAE

HS-016 711

## **RECOMMENDED U.S. AUTOMOTIVE EMISSION STANDARDS**

Balancing environmental, energy and transportation costs, this study concludes that U.S. Federal Standards for the 49 states, excluding California, should be set for the next five years, at two (2) hydrocarbon, 20 carbon monoxide and 3.1 oxides of nitrogen emission grams per mile. The use of lead additives up to approximately one gram/gallon will not violate actual or prospective ambient air quality standards and should be permitted. It will not be necessary to remove sulfur from gasoline with the engine technologies these standards permit. California needs stricter automotive emissions standards than those applicable to the 49 states. For the next ten years any changes in automotive standards that would increase cost or energy consumption should be justified on the basis of the specific health or aesthetic needs that are served by stricter standards. At these standards, a technology that is precluded by more restrictive standards, an engine with a high air/fuel rate can compete with the stratified charge and catalyst equipped engines.

Economics and Science Planning, Inc. 1200 18th St., N.W.,  
Washington, D.C. 20036  
1975 ; 35p 13refs  
Prepared for Science and Technology Policy Office, National  
Science Foundation Order No. 75-SP-0409  
Availability: Corporate author

HS-016 712

## **TRAFFIC CIRCULATION PLANNING FOR COMMUNITIES**

The objective of this study is to compile a methodology for traffic circulation planning, including principles and techniques that can be used by administrators and officials, engineers, and planners. The study provides practical recommendations based on the fundamental concept that circulation systems must be developed within the context of the total urban environment. The planning guidelines are developed from basic community-design concepts; they show how a simultaneous approach to community planning and circulation planning may proceed. The guidelines are intended primarily for the planning of new communities; however, they can also be applied to many problems in existing communities.

by H. Marks  
Gruen Associates, Los Angeles, Calif.  
1974 ; 296p 293refs  
Commissioned by Motor Vehicle Manufacturers Association,  
Inc.  
Availability: Corporate author

HS-016 713

## **EMERGENCY CARE AND TRANSPORTATION OF THE SICK AND INJURED**

A textbook for use by both student and teacher has been developed in order to provide a standardized education for emergency medical technicians. An orientation for the emergency medical technician includes discussions on personal attributes, responsibilities, response to emotional reactions, and relationships with hospital emergency departments. Studies of the systems of the human body are given. The major portion of this textbook is devoted to instruction in actual care of patients with specific injuries or illnesses, at the scene of onset, and during transportation to a medical facility. Sections on the ambulance, the helicopter, emergency driving, communications, records and reports are included.

The Committee on Injuries, American Acad. of Orthopaedic  
Surgeons, Chicago, Ill. 60611  
1971 ; 293p 55refs  
Availability: American Acad. of Orthopaedic Surgeons 430 N.  
Michigan Ave., Chicago, Ill. 60611

HS-016 714

## **YOU'RE A WHAT? (DRIVER EDUCATION)**

A partial observation of the driver education program of the Los Angeles Unified School District is presented in this interview with one of its teachers. Some problem areas for beginning drivers are related. Meeting traffic situations, coordinating the physical and mental requirements and initial nervousness are discussed. The use of automobile simulators is an integral part of the driver training program. Here the student uses a machine that allows him to stop, start, accelerate, brake, steer, and turn while movies of various traffic and driving situations are shown on a screen in front of him. Important points to remember include the following: think about driving when you are behind the wheel in order to get a total picture of the situation; keep your eyes moving; learn to predict possible hazards; use signals; leave a cushion of space behind the car in front of you when stopping; in making left turns never

turn wheels until actually making the turn; always use left lanes for left turns; periodically check the state drivers handbook for changes in the law; be familiar with regular driving routes; and be courteous.

Publ: DRIVER v8 n12 p8-13 (May 1975)

1975

Availability: See publication

HS-016 715

## TAKE YOUR MOTORCYCLE ALONG

Safe, legal transportation of a cycle on a recreational vehicle takes time and attention. Although larger cycles are more comfortable, smaller ones are easier to load. Front bumper mounts are illegal if the lights or driver's vision is blocked. Tail lights and clearance lights cannot be blocked and blocking the rear door of a camper if it is the only exit is also illegal. Hauling devices and carriers are discussed. Some campground regulations are given. A motorcycle state law requirement chart is included.

DRIVER v8 n12 p14-7 (May 1975)

1975

Availability: See publication

HS-016 716

## MICHIGAN DRIVER STATISTICS. REPORT NO. 7. JUNE 25, 1974

In this report on Michigan driver statistics the stress was on trend discernment to provide a clearer picture of what was happening to how many. 1973 was generally better than 1972 on both crash and violation behavior. Age grouping revealed a disproportionate alcohol involvement of younger drivers, and the male to female alcohol conviction ratio was 14 to 1. The repressive treatment of alcohol driving convictions was outnumbered by alcohol crash occurrences. The distribution of the driving population by birth year, sex, and age groups are presented.

Michigan Dept. of State, Lansing, Mich. 48918

1974 ; 25p

Availability: Corporate author

HS-016 717

## THE ROPS SAGA: OSHA SAYS ROLL-OVERS MUST BE SAFE

The Occupational Safety and Health Administration demands that bull-dozer, tractors, and other heavyweight vehicles must protect their operators during accidental roll over. The directive sounds simple, but implementation has been far from easy. It has forced industry into an extensive program of redesign and testing, culminating in a whole new family of energy-absorbing structures plus a test that simulates roll over without damaging costly vehicles.

by D. A. Locke

Saf-T-Cab, Inc., Fresno, Calif.

Publ: PROFESSIONAL SAFETY v20 n5 p32-7 (May 1975)

1975

HS-016 718

## SUICIDAL CRASHER. WATCH OUT FOR THE WRONG WAY DRIVER...DEATH MAY BE HIS OBJECTIVE

The wrong way driver may be deliberately trying to commit suicide. Personality characteristics of the over aggressive and neurotic driver are discussed. People with personality disturbances are more likely to be involved in accidents. In one study it was found that the socially obnoxious driver is more likely to die in a traffic accident than the socially well adjusted driver. Other studies corroborate these points. No valid method has been developed to screen these people during the licensing process, nor are there any laws to take them off the road for possible rehabilitation. Defensive driving is a motorist's best protection against the suicidal driver.

by W. L. Roper

Publ: CALIFORNIA HIGHWAY PATROLMAN v39 n3 p4-5, 20-1, 24-6, 29-30 (May 1975)

1975

Availability: See publication

HS-016 719

## EVERYTHING YOU NEED TO KNOW ABOUT TIRES

The terms "bias", "belted" and "radial" actually refer to a tire's ply construction. However, the real differences between these tires are the handling characteristics, tread strength, tread mileage and price. The bias ply tire is the lowest in price, offers the least tread mileage at the highest cost per mile. The bias belted tire uses special cord belts underneath the tread to add strength and stability to the tread. The radial ply tire is also belted, but the belts run around the tire body instead of meeting at an angle in the center of the tire. This type of body ply construction makes the radial the strongest, safest, best handling and longest wearing mileage tire. It is not recommended for use on cars with worn or damaged suspension systems. They are not to be used with other types of tires. Information on tire care such as inflation, rotation, load/overload, and inspection is presented.

DRIVER v8 n12 p1-7 (May 1975)

1975

Availability: See publication

HS-016 720

## HOW CONSCIOUS ARE YOUR DRIVING HABITS?

Awareness of driving habits is discussed. Points covered are: Lane switching, hazards presented by parked cars, wide swinging, right of way and forgetfulness. Defensive driving is recommended.

by A. Joseph

Publ: CALIFORNIA HIGHWAY PATROLMAN v39 n3 p13, 37-8 (May 1975)

1975

Availability: See publication

HS-016 721

**ENVIRONMENTALLY ASSISTED FRACTURING:  
RESEARCH AND STANDARDS**

Examination is made of the relation between research and standardization in the area of the environmentally assisted fracturing process particularly in the light of the progress which has been made in some of the areas of purely mechanical fracture and to a less extent, areas of purely chemical corrosion. Environmentally assisted fracturing processes are stress corrosion, liquid metal cracking, hydrogen embrittlement, and corrosion fatigue. Chemical and mechanical failure processes are listed and discussed as are the failure processes involving both chemical and mechanical factors. Control plans for environmentally assisted fracturing processes need to be more developed. The complex nature of this type of fracture necessitates reliance on macroscopic tests. These tests need to be further developed, validated, and accepted in such a manner as to build a national or international data bank.

by B. F. Brown  
Publ: ASTM STANDARDIZATION NEWS v3 n5 p8-16 (May 1975)  
1975 ; 16refs  
Availability: See publication

HS-016 722

**WHAT TO DO AFTER THE ACCIDENT**

Procedures to use following an accident are directed toward commercial drivers, fleet managers, and accident investigators. It is suggested that each fleet build a book of information to aid in the investigation of an accident. It should list by geographic location, attorneys, photographers, civil engineers, independent liability adjusting and investigating firms, and doctors. Preserving physical evidence is important for both court and warranty judgements. General state laws are discussed. A preliminary accident or loss report is illustrated.

by F. Sweeney  
Malsin Transport Corp.  
Publ: COMMERCIAL CAR JOURNAL p96-9 (Nov 1974)  
1974  
Availability: See publication

HS-016 723

**A CONTROLLED STUDY OF THE EFFECT OF  
TELEVISION MESSAGES ON SAFETY BELT USE**

This study shows that television campaigns have little effect on the use of safety belts, thus supporting the argument that approaches directed toward changing behavior are inefficient and often ineffective means of reducing highway losses. A controlled television campaign designed to increase the usage of seat belts and shoulder harnesses is thoroughly related. The attending study observed and recorded the use of seat belts by drivers from homes where the television messages were received on cable television as well as drivers who were from homes on the control cable without the messages. There was no significant difference in seat belt usage between the two groups. The apparent failure of a number of mass media safety belt campaigns to increase use may not mean that it is impossible to create a campaign which will increase seat belt use. However, the evidence on lack of effect of past efforts is suf-

gains in belt usage resulting from such campaigns is on those who advocate use of mass media to promote use of safety belts.

by L. S. Robertson; A. B. Kelley; B. O'Neill; C. W. Wixom;  
R. S. Eiswirth; W. Haddon, Jr.  
Insurance Inst. for Hwy. Safety, Washington, D.C. 20037  
Publ: AMERICAN JOURNAL OF PUBLIC HEALTH v64  
n11 p1071-80 (Nov 1974)  
1974 ; 25 refs  
Availability: See publication

HS-016 724

**HIGHWAY SAFETY PROGRAM EVALUATION AND  
RESEARCH**

A strong need for more rigid self-evaluation in highway safety programs is indicated. The lack of this has resulted in perpetuation of expensive programs which are not carrying their load in preventing accidental losses on our highways. Significant barriers to a comprehensive highway safety program evaluation include: convincing program managers that there is any need for evaluation in the first place; convincing program managers of the need for considering evaluation as a high priority factor in early planning before new program innovations are introduced; finding professional personnel to do the evaluation; finding a suitable training facility so that administrators and newly interested researchers can receive a survey of the art; and, finding a suitably objective means to evaluate the program once everything else is in order. Two significant factors working toward these goals are: Federal standards require evaluation; and, money can be budgeted for that purpose.

by B. J. Campbell  
University of North Carolina, Hwy. Res. Center  
Publ: TRAFFIC DIGEST AND REVIEW v18 n1 p6-11 (Jan 1970)  
1970  
Availability: See publication

HS-016 725

**HYDROGEN FUELED AUTOMOBILES**

There are no insurmountable technical problems that must be solved before hydrogen can be adopted as a synthetic fuel for use in transportation. Internal combustion engines, external combustion engines, and fuel cells either work best with hydrogen or are easily adapted to hydrogen fuel. The use of hydrogen in conventional or advanced engines tends to increase their efficiency while reducing polluting emissions. The cost of hydrogen and the cost of hydrogen storage onboard a vehicle are major economic barriers to the adoption of hydrogen fuel. Compressed gas storage is bulky and heavy and requires additional energy to compress the gas. The onboard storage of cryogenic liquid involves an expensive storage container, additional expense to liquify gaseous hydrogen, and the venting of boiloff gases which, besides being a safety problem, adds to the operating cost of the vehicle. The onboard storage of hydrogen in a metal hydride is an economic unknown. The heavy weight of the hydride increases the energy consumed by a vehicle, thereby increasing the cost of operation, and the hydride requires a heat of dissociation which may or may not be available as reject heat from the onboard engine or fuel cell. A review of work being conducted on transportation

hydrogen on a vehicle is presented. An economic comparison of the cost of operating a small intensively driven car for intercity use with various fuels, engines, and fuel storage methods is also presented.

by R. O. Voth

Publ: SELECTED TOPICS ON HYDROGEN FUEL,

Washington, 1975 p3.1-3.23

Rept. No. NBS-SP-419 ; 1975 ; 38refs

Availability: See publication

HS-016 731

## THE ALCOHOL CRASH STORY: NEWS MEDIA GUIDE

Some of the facts on alcohol and its involvement in street and highway crashes are discussed and directed to the news media and to the general public. Statistics on blood alcohol concentration (BAC) and ages and percentages of drinkers are presented. Youth-involved alcohol related crashes are discussed. A brief discussion of a national poll reflecting drink-drive attitudes is included in an effort to refute some misconceptions about drinking. Technology for screening and testing individual blood alcohol levels is explained and the need for heightened public awareness of the problem is stressed.

National Hwy. Traffic Safety Administration, Washington,

D.C. 20590

1975 ; 17p 6refs

Availability: GPO

HS-016 732

## TRAFFIC FATALITIES AND THE ENERGY CRISIS: A SECOND FOUR MONTH ANALYSIS MAY - AUG 1974

The traffic fatalities from May through August 1974 are analyzed with regard to the energy crisis. Fatality reduction, compared to past trends and to the same months of the previous year, is 17.6 percent below the 1973 level. Among the factors at work were gross reduction in traffic volume, shifts in travel patterns toward lower risk driving, and reduced speeds. It is concluded that reduced speeds accounted for approximately 8-9% of the 17.6% fatality reduction (about one-half) during the May-August period as compared to 8-9% of the 24.4% fatality reduction (about one-third) during January-April.

by J. F. Carpenter

General Motors Corp., Safety R & D Lab., Warren, Mich.

48090

Rept. No. A-3216 ; 1975 ; 11p 9refs

Availability: Corporate author

HS-601 817

## MULTIDISCIPLINARY ACCIDENT INVESTIGATION SUMMARIES VOL. 5, NO. 3

Case summaries are presented of recent in-depth reports submitted by NHTSA sponsored Multidisciplinary Accident Investigation Teams. These case reports are individual, clinical studies of accidents generally involving vehicles of the last three model years of fatal, injury producing, or property damage severity (severe enough so that at least one vehicle

must be towed from the scene). The teams investigate each accident in-depth, concerning themselves with each element of the collision (human, vehicle, environment) as it interacts with each phase of the collision (pre-crash, crash, post-crash). Each of the summaries consists of identification information, basic information on the highway and vehicles involved, a description of the drivers and occupants involved (with their injuries), a phase-by-phase description of the sequence of events of the collision, and a list of the causal factors, conclusions and recommendations which emanate from the reports. A diagram of each collision is included.

National Hwy. Traffic Safety Administration, Office of Accident Investigation and Data Analysis, 400, 7th St., S.W., Washington, d.c. 20590  
1974 ; 301p  
Availability: NTIS

HS-801 433

## ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES; PHASE 1: HIGH RISK DRIVER STUDY PLAN. REPORT

Several high risk drinking driver groups are defined, variables to be used in developing a predictive model of high risk drinking driving within these groups are specified, and a design is presented for a survey research operation which will discover these groups of high risk drinking drivers in the field, gather data on the relevant variables, and inductively develop best predicting equations from the data collected. Questionnaire forms are included, along with sampling plans and instructions.

by M. H. Wagner; J. H. Bigelow; J. Cobb; L. Goldstein; R. E. Kirkpatrick  
Technical Res. Associates, Inc. 10604 Warwick Ave., Fairfax, Va. 22030

Contract DOT-HS-4-00989

Publ: ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES, Washington, 1975, pAi-A52

1975 ; 55p 16refs

Study Design Plan Report for 1 Jun-31 Dec 1974.

Availability: NTIS, bound with HS-801 434-801 436

HS-801 434

## ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT ON PHASE 1

A six-month (Phase I) planning study was undertaken as the first step in a possible long-term, three-phase study. Phase I objectives included identification of potential high-risk groups and the development of plans for their study. Relevant literature was reviewed and data from selected in-house files were analyzed. No variables were found that unequivocally identified drivers at high risk to alcohol-related (A/R) crashes, and such drivers were found to be widely distributed. However, several variables consistently correlated with A/R crashes were found. The low incidence of A/R crashes among the general driving population was shown to create a significant identification problem that will result in a high false-positive rate among those predicted to have an A/R crash. Countermeasure programs directed to target groups known to contain a large number of false positives will necessarily be of limited scope. A carefully conceived and executed research program was recommended for the following target groups: drivers involved in A/R crashes; driving while intoxicated

(DWIs); blue collar workers with high absenteeism rates; as-signed-risk insureds; and divorcing persons.

by L. D. Filkins; C. P. Compton, R. L. Douglass; J. D. Flora University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy and Baxter Rd., Ann Arbor, Mich. 48105

Contract DOT-HS-4-00990

Publ: ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES, Washington, 1975 pBi-114

Rept. No. UM-HSRI-AL-74-8; 1975; 117p 62refs

Rept. for 1 Jun-31 Dec 1974.

Availability: Bound with HS-801 433 and 801 435-801 436

HS-801 435

## **ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT**

An approach was developed to enhance the precision of predicting alcohol related crash involvement and to facilitate the application of appropriate precrash countermeasures. The approach assumed that there were small, identifiable high risk groups, and that prediction models could be developed to identify individuals with a high probability of crash involvement within the groups. The development of selection criteria for the high risk groups was constrained by the practical considerations of countermeasure application and the availability and cost of the data required for an ongoing program of target selection and precrash countermeasures. Five high risk driver groups were identified through a review of previous research on alcohol related crash involvement. Each group was made up of male drivers only, and was further defined by one or more of the following: age, recent change in marital status, hazardous moving violation record, and Alcohol Safety Action Project driving-while-intoxicated record. The estimated size of the resulting target groups ranged from less than 1% to about 7% of the male driver population. Detailed plans and specifications were prepared for developing and validating a model to predict crash involvement among group members.

by R. E. Hagen; D. H. Harris; A. Burg

Anacapa Sciences Inc., 2034 De La Vina St., Santa Barbara, Calif. 93102

Contract DOT-HS-4-00991

Publ: ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES, Washington, 1975 pCi-85

1975; 94p 31refs

Report for 1 Jun-31 Dec 1974.

Availability: Bound with HS-801 433, 801 434, and 801 436

HS-801 436

## **ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT**

Five types of drivers have been identified as having high accident probabilities relative to the general driving population: the "driving under the influence of alcohol" group; the youth group; the alcohol abuse group; the non-traffic violation arrest group; and the stress group. This research plan draws a sample of drivers of each identified type as well as two accident samples: personal injury accidents and fatal accidents. The research strategy and its underlying rationale are summarized, the intended data sources, data collection procedures, and analytic treatments discussed, and an administrative plan, complete with task breakdowns and time phases, presented.

Key differences between this research plan and its predecessors are: its emphasis on finding higher and lower risk member of driver types already known to be high risk; its allowance for different accident types to be associated with different driver attributes; and its realization that the importance of one driver attribute may well depend upon the presence or absence of another. The study is expected to yield several products useful to administrators concerned with traffic safety.

by T. S. Overton; W. Douglas; B. J. Bagdis; M. G. Temple Ketrion Inc., 530 E. Swedesford Rd., Wayne, Pa. 19087

Contract DOT-HS-4-00992

Publ: ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES, Washington, 1975 pDi-79

1975; 83p 49refs

Report for 1 Jun-31 Dec 1974.

Availability: Bound with HS-801 433-801 435

HS-801 491

## **SAFE PERFORMANCE CURRICULUM FOR SECONDARY SCHOOL DRIVER EDUCATION: PROGRAM DEVELOPMENT, IMPLEMENTATION, AND TECHNICAL FINDINGS. FINAL REPORT**

To determine the effectiveness of a model driver education curriculum in leading to safe vehicle operation among beginning drivers, the Safe Performance Curriculum was developed and pilot tested. The curriculum was based on instructional objectives derived from an analysis of the driver's tasks. In the pilot test, students were randomly assigned to one of the following: Safe Performance Curriculum (SPC); a Pre-Driver Licensing (PDL) course, consisting of instruction in the minimum requirements needed for the granting of a driver's license; or a control group, which received no formal instruction through the secondary school system. Intermediate criterion measures of performance, knowledge, skill and attitude were administered to students in the first two groups. Program effects were measured in terms of curriculum (SPC vs PDL), sex, and scholastic achievement level (lower vs. upper half of class). Evaluation of knowledge and performance measures indicated a general trend toward higher scores by the SPC students, by students in the upper half of their class, and by male students. Recommendations are made for further revision and refinement of the intermediate criterion measures and for a follow-up study using a more controlled experimental design and a larger number of subjects.

by M. C. Riley; R. S. McBride

Human Resources Res. Organization 300 N. Washington St., Alexandria, Va. 22314

Contract DOT-HS-003-2-427

Rept. No. HumRRO-TR-74-23; 1975; 270p

Report for 14 Jun 1974-21 Oct 1974.

Availability: NTIS

HS-801 496

## **MULTIDISCIPLINARY ACCIDENT INVESTIGATION SUMMARIES VOL. 6, NO. 9**

Case summaries are presented of recent in-depth reports submitted by NHTSA sponsored Multidisciplinary Accident Investigation Teams. These case reports are individual, clinical studies of accidents generally involving vehicles of the last three model years of fatal, injury producing, or property damage severity (severe enough so that at least one vehicle

must be towed from the scene). The teams investigate each accident in-depth, concerning themselves with each element of the collision (pre-crash, crash, post-crash). Each of the summaries consists of identification information, basic information on the highway and vehicles involved, a description of the driver and occupants involved (with their injuries), a phase-by-phase description of the sequence of events of the collision, and a list of the causal factors, conclusions and recommendations which emanate from the reports. A diagram of each collision is included.

National Hwy. Traffic Safety Administration, Office of Accident Investigation and Data Analysis, 400 7th St., S.W., Washington, D. C. 20590  
1975 ; 330p  
Availability: NTIS

HS-801 497

### **MULTIDISCIPLINARY ACCIDENT INVESTIGATION SUMMARIES VOL. 6, NO. 7**

Case summaries are presented of recent in-depth reports submitted by NHTSA sponsored Multidisciplinary Accident Investigation Teams. These case reports are individual, clinical studies of accidents generally involving vehicles of the last three model years of fatal, injury producing, or property damage severity (severe enough so that at least one vehicle must be towed from the scene). The teams investigate each accident in-depth, concerning themselves with each element of the collision (pre-crash, crash, post-crash). Each of the summaries consists of identification information, basic information on the highway and vehicles involved, a description of the driver and occupants involved (with their injuries), a phase-by-phase description of the sequence of events of the collision, and a list of the causal factors, conclusions and recommendations which emanate from the reports. A diagram of each collision is included.

National Hwy. Traffic Safety Administration, Office of Accident Investigation and Data Analysis, 400 7th St., S.W., Washington, D.C. 20590  
1975 ; 289p  
Availability: NTIS

HS-801 500

### **MULTIDISCIPLINARY ACCIDENT INVESTIGATION SUMMARIES VOL. 6, NO. 3**

Case summaries are presented of recent in-depth reports submitted by NHTSA sponsored Multidisciplinary Accident Investigation Teams in a continuing series of publications. These case reports are individual, clinical studies of accidents generally involving vehicles of the last three model years of fatal, injury producing, or property damage severity (severe enough so that at least one vehicle must be towed from the scene). The teams investigate each accident in-depth, concerning themselves with each element of the collision (human, vehicle, environment) as it interacts with each phase of the collision (pre-crash, crash, post-crash). Each of the summaries consists of identification information, basic information on the highway and vehicles involved, a description of the driver and occupants involved (with their injuries), a phase-by-phase

which emanate from the reports. A diagram of each collision is included.

National Hwy. Traffic Safety Administration, Office of Accident Investigation and Data Analysis, 400 Seventh St., S.W., Washington, D.C. 20590  
1975 ; 320p  
Availability: NTIS

HS-801 507

### **AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 1. ENGINEERING MANUAL. FINAL REPORT**

A digital computer program to simulate in three dimensions one or more motor vehicle crash victims, either occupant or pedestrian, has been developed, and numerous improvements in the modeling have been made. Disjoint sets of connected rigid bodies may be specified, simulating multiple victims and victim interaction. Additional ellipsoids and/or planes may be attached to any segment. Position, rolling, and sliding constraints between segments is now a user option. Modeling of impulsive forces arising at first contact has been incorporated, and improved modeling of joint-stop torques plus the capability of locking and unlocking joints has been added. Adjustments to the exponential integration technique has reduced run time substantially. Because of these improvements, the model is no longer restricted to a particular crash victim and may be considered a general three dimensional simulation. General math and geometry relationships are discussed, including: coordinates and vector/matrix notation; rotations, quaternions, and direction cosine matrices; and determination of yaw, pitch, and roll angles or euler angles from direction cosine matrix. Rigid body equations of motion are examined, including general rigid body motion and comparison of Lagrangian and Newtonian techniques for deriving them. Equations of motion of a set of connected rigid bodies are discussed in terms of segment motion equations, connectivity, constraint equations, tension element, flexible element parameters, singular segments, and a description of the matrices in the system equations. Solution of the system equations covers the symmetry option and exponential integration method. Computation of joint torques includes spring and viscous torques, joint stop model, and euler joint model. Forces produced by contacts include plane ellipsoid contact, intersection of ellipsoids, restraint belt contact, airbag contact, force deflection model, and impulse forces. An improved shoulder joint model, program restrictions, program features provided by input, and verification of the program features are also mentioned.

by J. T. Fleck; F. E. Butler; S. L. Vogel  
Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221  
Contract DOT-HS-053-2-485  
Rept. No. ZQ-5180-L-1 ; 1975 ; 292p 16 refs  
Report for 30 Jun 1972-31 Jul 1974. Vols. 2-4 are HS-801 508--  
HS-801 510.  
Availability: NTIS

HS-801 508

### **AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2. MODEL VALIDATION. FINAL REPORT**

pedestrian, was developed, and numerous improvements in the modeling have been made. Because of these improvements, the model is no longer restricted to a particular crash victim simulation and may be considered a general three dimensional simulation. Validation of the model and the air bag submodel is described along with details of the experimental validation procedure for measurements of dummy characteristics, impact sled tests, full-scale automobile crash test, and air bag validation tests.

by J. T. Fleck; F. E. Butler; S. L. Vogel  
Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221  
Contract DOT-HS-053-2-485  
Rept. No. ZQ-5180-L-1 ; 1975 ; 268p 15refs  
Report for 30 Jun 1972-31 Jul 1974. Vol. 1 is HS-801 507; vols. 3-4 are HS-801 509--HS-801 510.  
Availability: NTIS

HS-801 509

### **AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 3. USER MANUAL. FINAL REPORT**

The user's manual for the improved three dimensional simulation of vehicle crash victims is presented. Details of the digital computer program are specified, including: input and output data features; description of the restart procedure; error messages; job control language IBM 370; input description; sample input and output; program variable dictionary by labeled common blocks; analysis variable dictionary; verification of program features; and subroutine, common block and variable cross reference charts.

by J. T. Fleck; F. E. Butler; S. L. Vogel  
Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221  
Contract DOT-HS-053-2-485  
Rept. No. ZQ-5180-L-1 ; 1975 ; 204p 10refs  
Report for 30 Jun 1972-31 Jul 1974. Vols. 1-2 are HS-801 507--801 508; vol. 4 is HS-801 510.  
Availability: NTIS

HS-801 510

### **AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 4. PROGRAMMERS MANUAL. FINAL REPORT**

A digital computer program for three dimensional to simulation of one or more motor vehicle crash victims, either occupant or pedestrian, was developed, and numerous improvements in the modeling have been made. Because of these improvements, the model is no longer restricted to a particular crash victim simulation and may be considered a general three-dimensional simulation. The programmers manual includes: a description of program flow; the program variable dictionary by labeled common blocks; the analysis variable dictionary; subroutine, common block, and variable cross reference charts; input and subroutine description; and source listing.

by J. T. Fleck; F. E. Butler; S. L. Vogel  
Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221  
Contract DOT-HS-053-2-485  
Rept. No. ZQ-5180-L-1 ; 1975 ; 490p 10refs  
Report for 30 Jun 1972-31 Jul 1974. Vols. 1-3 are HS-801 507--801 509.  
Availability: NTIS

HS-801 515

### **MULTIDISCIPLINARY ACCIDENT INVESTIGATION PROGRAM. FINAL REPORT**

A three-phase project in traffic safety is reported. The phases included: in-depth investigation of 55 selected, severe motor vehicle accidents; a one-year study of post-crash factors in automobile collisions; and supplementary studies. A summary of the 55 multidisciplinary accident investigations is presented as well as a compilation of the findings of each investigation, and an investigation of the effectiveness of occupant restraint systems.

by F. R. Wagner; J. A. Austin  
University of Utah, Salt Lake City, Utah 84112  
Contract DOT-HS-047-1-063  
Rept. No. UTEC-ME-74-043 ; 1975 ; 312p 2refs  
Report for 15 Mar 1972-15 Jan 1974.  
Availability: NTIS

HS-801 517

### **BASIC TRAINING PROGRAM FOR DRIVER LICENSE EXAMINERS: CONCEPTS AND RECOMMENDATIONS -- FINAL REPORT**

The results and developmental methodology behind the construction of a basic training program for training driver license examiners are presented. The developed training program provides the minimum course of instruction and covers the minimum knowledge and skill requirements needed for an individual to function as a driver license examiner, including guidelines for instructional and supporting materials. The complete program is scheduled for a maximum of 80 hours apportioned as follows: 35 hours classroom instruction, 30 hours of practice sessions, 7 hours of discussion break time, 3 hours lesson summary time, 5 hours of cushion time for specialized uses. The program is designed on a modular basis to permit flexibility in state adaptation. This report presents materials which can be utilized as instructor lesson plans and guideline preparation documents. Student training materials are also supplied along with course presentation guidelines and recommendations.

by L. L. Malany; J. T. Pendleton  
Technical Education Res. Centers, Inc. Midwest Center,  
Champaign, Ill. 61820  
Contract FH-11-7537  
1975 ; 33p  
See also HS-800 536, HS-800 577-578 Report for Aug 1970-31 Mar 1972  
Availability: NTIS

HS-801 519

### **STUDY OF POST-CRASH FACTORS IN AUTOMOBILE COLLISION. VOL. 1. FINAL REPORT**

The results of a study into post-crash factors (fire, submergence, fuel leakage, and extrication-evaluation) in automobile collisions are presented in a final report which is part of the Utah Multidisciplinary Highway Crash Investigation Research. Study statistics are given with respect to characteristics of the driving population, vehicle population, and accident population; and are compared to the State of Utah and national statistics in order to assess the study area representativeness. The incidence rates for each of the four post-crash factors was

assessed, based on data collected over a one-year period. The standard police report and a supplemental accident report were used to identify the post-crash factors of interest. For those accidents where one of the post-crash factors was involved, a detailed follow-up of the vehicle was conducted where possible. Through this examination an attempt is made to determine those factors that tend to aggravate or ameliorate the occurrence and consequences of the post-crash phenomena.

by J. A. Austin; F. R. Wagner; A. Hogan; G. Bryner  
University of Utah, Utah Auto Crash Res. Team, Salt Lake City, Utah 84112  
Contract DOT-HS-047-1-063  
1975 ; 95p  
Report for 15 Mar 1972-15 Nov 1973  
Availability: NTIS

HS-801 520

### **STUDY OF POST-CRASH FACTORS IN AUTOMOBILE COLLISIONS. VOL. 2. FINAL REPORT**

Appendices are presented for a study into post-crash factors, such as fire, submergence, fuel leakage, and extrication-evacuation, in automobile collisions, part of a special studies effort of the Utah Multidisciplinary Highway Crash Investigation Research. The appendices include: investigating officer's report of traffic accident for Utah; state data file; fire and post-crash cases; submergence cases and submergence sites; fuel leakage data by vehicle; possible injury aggravation cases in extrication-evacuation; foreign cars extrication-evacuation; frame construction; and supplemental accident report forms.

by J. A. Austin; F. R. Wagner; A. Hogan; G. Bryner  
University of Utah, Utah Auto Res. Team, Salt Lake City, Utah 84112  
Contract DOT-HS-047-1-063  
1975 ; 179p  
Report for 15 Mar 1972 - 15 Nov 1973  
Availability: NTIS

HS-801 523

### **RECREATIONAL VEHICLE ACCIDENT INVESTIGATION STUDY. INTERIM REPORT**

The scope of the recreational vehicle (RV) accident investigation study includes three primary levels of effort. Level 1 covers baseline data on drivers, vehicles and highways in the study area, the motor vehicle accident experience and recreational facilities in the study area, and the exposure and accident rates of RV's in the study area as compared to national baseline data. Level 2 consists of bi-level investigations by police/engineering personnel on a large sample of RV accidents, and level 3, an in-depth investigation of 50 RV accidents by a multidisciplinary team. The findings reported reflect the interim trends emerging from these data and are not considered conclusive. Interim findings include: RV's are excessively represented in overall traffic accident experience; the frequency of appearance of trailer towing as a variable in RV accident experience is excessive; RV trailers with two or more axles are over-represented in the RV trailer accident experience; the most frequently reported mechanical malfunction in RV accidents is trailer hitch failure; and trailers with characteristically high centers of gravity and/or low weight to wind pres-

sure area ratios are over-represented in the RV trailer accident experience.

by J. W. Hutchinson; R. V. Sayre; J. A. Dearing  
University of Kentucky Multidisciplinary Accident Study Team, Dept. of Civil Engineering, Lexington, Ky. 40506  
Contract DOT-HS-201-3-766  
Rept. No. UK-766-Interim ; 1975 ; 253p  
Report for 1 Jul 1973-30 Jun 1974.  
Availability: NTIS

HS-801 527

### **PASSENGER CAR AND LIGHT TRUCK SHOCK ABSORBER INSPECTION EQUIPMENT VOL. 1 -- SUMMARY REPORT. FINAL REPORT**

Four commercial on-the-vehicle shock absorber testers were evaluated for suitability with periodic motor vehicle inspection programs. Tests were conducted on five vehicles using shock absorbers of known quality. A study was also conducted to determine the effects and modes of shock absorber degradation, and the range of shock absorber damping in the prevailing vehicle population. It was concluded that, of the testers evaluated, a wheel vibration tester was the only type suitable for periodic motor vehicle inspection purposes. The use of this type tester as an inspection tool is discussed. It was also concluded that shock absorber inspection using any technique is only marginally attractive economically.

by R. D. Wooten  
Tracor Jitco, Inc., 1776 E. Jefferson St., Rockville, Md. 20852  
Contract DOT-HS-256-3-755  
Rept. No. TJ-102-019 ; 1975 ; 26p 5ref  
Report for Jul 1973 -- Aug 1974  
Availability: NTIS

HS-801 528

### **DEVELOPMENT OF AN ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT CAR DRIVERS. FINAL REPORT**

The analyses, design and testing that were conducted to develop an air bag restraint system for the subcompact car capable of protecting the driver in frontal and frontal oblique crashes up to 50 mph are summarized. The results of this work has been the development of a small, rapidly inflating dual air bag (inner and outer bags) mounted to a stroke efficient energy absorbing steering column. The lower body energy is absorbed by a crushable knee restraint fabricated of styrofoam. The system ultimately proved capable of protecting subcompact car drivers throughout the adult anthropometric size range at velocities exceeding 50 mph. The finalized restraint system is constructed of components that are oriented toward eventual mass production.

by M. Fitzpatrick  
Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017  
Contract DOT-HS-113-3-742  
1975 ; 225p 5refs  
Report for Jun 1973 -- Nov 1974  
Availability: NTIS



HS-801 529

# **DEVELOPMENT OF A SCHOOL BUS FUEL SYSTEM INTEGRITY COMPLIANCE PROCEDURE. FINAL REPORT**

A program is presented that derived a compliance test procedure for school buses with a gross vehicle weight of 10,000 pounds or greater. The objective of the program was to evaluate FMVSS 301 in relation to school buses, conduct a limited state-of-the-art survey and run full-scale dynamic tests to produce an effective procedure that will improve the crash-worthiness of school bus fuel systems.

by G. W. Morrow; N. B. Johnson  
Ultrasystems, Inc., The Dynamic Science Div., 1850 West  
Pinnacle Peak Rd., Phoenix, Ariz. 85027  
Contract DOT-HS-4-00872  
Rept. No. UI-2310-75-90; 1975; 59p  
Availability: NTIS

HS-801 530

# **PASSENGER CAR AND LIGHT TRUCK SHOCK ABSORBER INSPECTION EQUIPMENT. VOL. 2 -- TECHNICAL REPORT. FINAL REPORT**

Five vehicles using shock absorbers of known quality were equipped with commercial on-the-vehicle shock absorber testers. Objective was the development of a rationale for the inspection of shock absorbers, and the identification of suitable equipment for testing them while mounted on the vehicle. The shock absorbers were tested on a CGS electro-hydraulic test machine capable of harmonically oscillating the shock absorbers over a wide frequency and stroke range. Degradation was evaluated. A survey of discarded shock absorbers, recently removed from vehicular service, was made. Tests on the artificially degraded shock absorber showed that in most cases mechanical component degradation resulted in much greater losses in control at low speed. Conclusion was that high velocity in a shock absorber tester is important only in so far as high velocity helps to isolate suspension friction from shock absorber damping. Bounce tests were made and the conclusion is that if shock absorbers are going to be inspected, it is preferable to conduct the tests objectively rather than rely on subjective opinion. While a wheel vibration tester seemed the type most suitable for periodic inspection programs, modifications in testers will be necessary before a cost beneficial inspection program actually results.

by R. D. Wooten  
Tracor Jitco, Inc., 1776 E. Jefferson St., Rockville, Md. 20852  
Contract DOT-HS-256-3-755  
Rept. No. TJ-102-019; 1975; 157p refs  
Report for Jul 1973 -- Aug 1974  
Availability: NTIS

HS-801 540

# **THEORETICAL STUDY OF NONLINEAR MEMBRANE PROBLEMS WITH APPLICATIONS TO AIR BAGS. FINAL REPORT**

The deformed configurations of air bags are obtained by

energy density function that describes the material of the air bag. The strain energy density for the potential energy functional minimized in the examples is based on the Mooney strain energy density. The deformed configuration of an air bag is assumed to be represented by a series of trigonometric functions with unknown coefficients. The unknown coefficients are determined by the Newton-Raphson method for axisymmetric problems and Fletcher and Powell's method for non-axisymmetric problems. The slack variables are used to convert the inequality constraint into an equality constraint for nonaxisymmetric contact problems. The solution may justifiably be compared to a numerical integration of the corresponding equilibrium equations. The energy solution is in excellent agreement with previously published solutions for the inflation of a circular membrane and for the inflation of a rectangular membrane of neo-Hookean material. Solutions to several sample problems related to air bags are presented.

Carnegie-Mellon Univ., Mechanical Engineering Dept.,  
Pittsburg, Pa. 15213  
Contract DOT-HS-263-2-470  
1975; 164p 16refs  
Report for Jun 1972 -- Aug 1973  
Availability: NTIS

HS-801 542

# **VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 2 -- ANALYSIS OF ACCIDENT INFORMATION. FINAL REPORT**

Statistical analysis of 263 pedestrian accident records was conducted in search of injury causation factors. Multivariate analysis and item selection techniques were used to evaluate the data. Several injury causing parameters are identified, including vehicle speed, vehicle mass, pedestrian mass, vehicle height (from ground level to point of impact on pedestrian), pedestrian height and the vehicle/pedestrian attitude. These parameters in turn define three quantities that were found to be important in injury prediction: the net kinetic energy at impact, the ratio of vehicle height to pedestrian height, and the vehicle/pedestrian attitude. Recommendations are made for improving the mathematical model and for standardizing accident reporting systems.

by A. M. Mayyasi; U. W. Pooch  
Texas A and M Univ., Texas Transportation Inst., College  
Station, Tex. 77843  
Contract DOT-HS-065-1-217  
Rept. No. RF-814-1-Vol-2; 1975; 190p 10refs  
Report for Jul 1971 -- Aug 1972. Vol. 1 is HS-801 541; vols. 3 and 4 are HS-801 543 and 801 544; vol. 5 is HS-801 547.  
Availability: NTIS

HS-801 544

# **VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON A MOCK VEHICLE EXTERIOR. FINAL REPORT**

A series of drop tests was conducted with instrumented male, female, and child anthropometric dummies for data to validate a numerical simulator. High-speed cameras recorded dummy kinematics and accelerations were recorded on magnetic tape.

tribution, segment moments of inertia, joint damping properties, geometry, and surface force-deformation properties were measured. Force-deformation properties of the mock-up surface (polyurethane foam) were experimentally and analytically determined. Measurements of the coefficient of friction between the mock-up surface and the dummy's skin were also made. No attempt was made to draw any conclusions regarding the significance of the drop tests as related to the pedestrian accident itself. The results could be used to validate simulators other than those used in these tests.

by H. E. Ross, Jr.; M. C. White; R. D. Young; W. F. Lammert  
Texas A and M Univ., Texas Transportation Inst., College Station, Tex. 77843  
Contract DOT-HS-065-1-217  
Rept. No. RF-814-1-Vol-4 : 1975 : 165p 2refs  
Report for Jul 1971-Jul 1973. Vols. 1-3 are HS-801 541-HS-801 543; vol. 5 is HS-801 547.  
Availability: NTIS

HS-801 547

#### **VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF A CRASH VICTIM -- EXTENSION AND VALIDATION STUDY. FINAL REPORT**

Various additions and extensions are described of an occupant model needed to simulate the pedestrian accident victim and the model's performance in simulating the drop tests. The modifications include changes to the victim-vehicle interaction subroutines, victim geometry, and vehicle geometry. Details are given for the body dynamics model, formulation and solution of equations of motion, gravity forces, and joint forces. In general, the computer simulation reported does predict the kinematics of a pedestrian struck by a vehicle and the g-levels experienced by the victim, and this success is borne out in the results of the validation study described in the last chapter. In all cases, the simulation was excellent during primary impact and in most cases continued to compare well with the high-speed film results until after the dummy lost contact with the vehicle mockup. It is concluded that the Texas Transportation Institute Crash Victim Simulator is ready for use in a parameter study aimed at determining the degree of reduction of injury that can be expected from vehicle exterior modifications on stiffness and shape, or determining what modifications would be effective in reducing injuries.

by R. D. Young; W. F. Lammert; H. E. Ross, Jr.  
Texas A and M Univ., Texas Transportation Inst., College Station, Tex. 77843  
Contract DOT-HS-065-1-217  
Rept. No. RF-814-1-Vol-5 : 1975 : 343p 30refs  
Report for Jul 1971-Jul 1973. Vols. 1-4 are HS-801 541-HS-801 544.  
Availability: NTIS

HS-801 557

#### **THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES) VOL. 1 EXECUTIVE SUMMARY. FINAL REPORT**

by J. W. Melvin; A. S. Wineman  
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor, Mich. 48105  
Contract DOT-HS-031-3-763  
Rept. No. UM-HSRI-BI-74-2-1 : 1975 : 34p 26refs  
Report for 1 Jul 1973-31 Jul 1974. Vols. 2 and 3 are HS-801 558 and 801 559.  
Availability: NTIS

HS-801 558

#### **THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES). VOL. 2. TECHNICAL REPORT. FINAL REPORT**

Mechanical properties, including stress, strain, and rupture strength, are determined for various human tissues that are directly applicable to the thoracic injury problem as defined in the finite element model of the human thorax that is being developed by the Franklin Institute Research Laboratory. The properties were determined at strain rates that can occur during fatal automobile accidents. The properties of rhesus monkey tissues are also of interest in the modeling effort, and consideration was given to providing experimental data on selected rhesus monkeys as well as human tissues. Test techniques used were uniaxial tension tests, biaxial tension tests, and structural tests. Tests were performed on samples of human tissue from the intercostal muscle, the cardiac muscle, the aorta, the pericardium, the diaphragm, intervertebral ligaments, the esophagus, and the trachea and bronchi. In addition, tests were performed on many of the same tissues and the lungs of Rhesus monkeys. Results of the tests indicate that the dynamic response of thoracic tissues is considerably different from the static response in terms of stress, but that the strain response is more dependent upon pathological condition of the tissues than upon strain rate.

by J. W. Melvin; A. S. Wineman  
University of Michigan, Hwy. Safety Res. Inst., Ann Arbor, Mich. 48105  
Contract DOT-HS-031-3-763  
Rept. No. UM-HSRI-BI-74-2 : 1975 : 169p 26refs  
Report for 1 Jul 1973-31 Jul 1974. Vol. 1 (executive summary) is HS-801 557 and vol. 3 is HS-801 559.  
Availability: NTIS

HS-801 559

#### **THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES). VOLUME 3. LITERATURE SURVEY. FINAL REPORT**

Results are presented of an extensive literature survey which concentrated on soft tissue testing and the analytical representation of soft tissue mechanical behavior. A list of journals

cards prepared during the project are shown. Over 500 cards are included.

by J. W. Melvin; A. S. Wineman  
University of Michigan, Hwy. Safety Res. Inst., Huron Pkwy.  
and Baxter Rd., Ann Arbor, Mich. 48105  
Contract DOT-HS-031-3-763  
Rept. No. UM-HSRI-BI-74-2-3 ; 1975 ; 284p  
Report for 1 Jul 1973-31 Jul 1974. Vols. 1 and 2 are HS-801 557  
and HS-801 558.  
Availability: NTIS

HS-801 569

## FEASIBILITY STUDY OF IN-VEHICLE WARNING SYSTEMS. FINAL REPORT

In-vehicle warning system (IVWS) is a means of warning the motor vehicle driver that his path is about to intersect that of a train, emergency vehicle, or other source of danger to him. The system comprises a transmitted warning from a source, and a relay station within the motor vehicle for informing the driver of the particular danger. In an effort to study the feasibility of various in-vehicle warning systems, extensive literature searches were conducted, data on grade crossing and emergency vehicle accidents were collected and field investigations including grade crossing observation from ground and train level, and riding in emergency vehicles during a variety of conditions, were conducted. Study indicated that a major cause of accidents between motor vehicles and trains or emergency vehicles is nonrecognition of a warning by a driver. This may be attributed to driver behavior, fatigue, physical condition, displacement of judgement under pressure, disregard of traffic rules, traffic patterns, or environmental conditions. Nonrecognition may also be caused by factors such as acoustically isolated vehicle interiors. In-vehicle warning systems (IVWS) have a potential for being an effective countermeasure in over half of the present accidents if system design could provide adequate range, signal clarity, and user confidence. Such characteristics require a technological level beyond a simple transmitter and receiver system. While present results indicate that an IVWS that is limited to the train and emergency vehicle problems would not result in saving enough lives to justify its projected costs, consideration of the merits of this countermeasure may change in the future as new information becomes available. One additional issue that needs to be explored in more detail is the utility of incorporating train and emergency vehicle warning functions in a larger, comprehensive vehicle-highway communications systems.

by D. D. Peterson; D. S. Boyer  
Tracor Jitco, Inc., 1776 E. Jefferson St., Rockville, Md. 20852  
Contract DOT-HS-256-3-752  
1975 ; 146p 27refs  
Report for Jul 1973-Mar 1975  
Availability: NTIS

HS-801 590

## DEVELOPMENT OF IMPROVED INFLATION TECHNIQUES. TASK 3 -- SYSTEM PERFORMANCE EVALUATION. 15TH PROGRESS REPORT. 1 JANUARY TO 31 JANUARY 1975

Program objectives for this reporting period were to conduct static tests to reduce bag inflation time and to use a lighter weight bag, and to conduct a third week of sled testing with the two modifications. After two tests with lighter weight bag material, it was felt that the complete air bag system could not be fabricated from the light weight material due to the lower inflation pressures in the augmented bag. Two tests were conducted with bags fabricated from 7.5 oz/yd material to reduce the inflation time from the previous 40-42 ms obtained prior to and during the previous sled test series. These two tests resulted in 34-37 ms inflation times which should improve the chest loadings on the 50th percentile male. Ten sled tests conducted with a lighter bag weight (lower bag 7.5 oz/yd material and upper bag 5.5 oz/yd material) indicated that the lighter weight bag improved the bag slap loadings on the six-year-old child and the chest loadings were within the specification. The reduced inflation time decreased the chest loadings on the 50th percentile male to allow for an improved safety margin.

Olin Corp., Energy Systems Operation, Marion, Ill. 62959  
Contract DOT-HS-345-3-691  
Rept. No. PR-15 ; 1975 ; 16p  
Availability: NHTSA

HS-801 591

## DEVELOPMENT OF IMPROVED INFLATION TECHNIQUES. TASK 3 -- SYSTEM PERFORMANCE EVALUATION. 16TH PROGRESS REPORT. 1 FEBRUARY TO 31 MARCH 1975

The program objective for the reporting period was to install restraint systems in crash cars and conduct two or three frontal impact tests. Two of the car crashes were conducted, one a 30 mph frontal impact and the other a 40 mph frontal impact. Preliminary results indicate both crashes met the injury criteria of FMVSS 208. The passenger movements on the 30 mph test looked good. There was a rather high SI loading on the chest corresponding to a rather high SI acceleration on the vehicle. During the 40 mph test the passenger submarined and caught the femurs between the knee restraint and front of the seat, and also appeared to have ridden through the air bag and contacted the dash or restraint system during ridedown. The rather high SI chest loadings present in the 30 mph test were eliminated in the 40 mph test by placing foam under the seat to cushion the response from the vehicle SI loadings.

Olin Corp., Energy Systems Operation, Marion, Ill. 62959  
Contract DOT-HS-345-3-691  
Rept. No. PR-16 ; 1975 ; 13p  
Availability: NHTSA  
1975



## **INDEX to ABSTRACTS**



# KWOC Title Index

### ABBREMSSEN

OPTIMALES ABBREMSEN EINES FAHRZEUGES BEI KURVENFAHRT (OPTIMAL VEHICLE BRAKING DURING A TURN)

HS-016 503

### ABRASION

EVALUATION OF TIRE ABRASION IN TERMS OF DRIVING SEVERITY

HS-016 706

### ABSORBER

PASSENGER CAR AND LIGHT TRUCK SHOCK ABSORBER INSPECTION EQUIPMENT VOL. 1 -- SUMMARY REPORT. FINAL REPORT

HS-801 527

PASSENGER CAR AND LIGHT TRUCK SHOCK ABSORBER INSPECTION EQUIPMENT. VOL. 2 -- TECHNICAL REPORT. FINAL REPORT

HS-801 530

### ABSORBING

A RESEARCH STUDY FOR AN ENERGY ABSORBING SLIDING SEAT

HS-016 610

FACTORS INFLUENCING THE PERFORMANCE OF THE ENERGY ABSORBING STEERING COLUMN IN ACCIDENTS

HS-016 578

SOME METHODS OF ABSORBING THE ENERGY OF MOTOR VEHICLES AND THEIR OCCUPANTS

HS-016 611

THE DUNLOP MK 2 COMPOSITE ENERGY ABSORBING BUMPER SYSTEM

HS-016 615

### ABSORPTION

A PRACTICAL APPROACH TO THE PROTECTION OF MOTOR VEHICLES BY THE ABSORPTION [ABSORPTION] OF IMPACT ENERGY

HS-016 620

### ABSORPTION

A PRACTICAL APPROACH TO THE PROTECTION OF MOTOR VEHICLES BY THE ABSORPTION [ABSORPTION] OF IMPACT ENERGY

HS-016 620

CHARACTERISTICS OF BODY ENERGY ABSORPTION AND RESTRAINT SYSTEM

HS-016 623

ENERGY ABSORPTION BY VARIABLE SHEAR STRENGTH DUPLEX MATERIALS

HS-016 616

THE ROLE OF EXTRUSION DEVICES IN ENERGY ABSORPTION FOR SAFETY

HS-016 614

### ACRS

NHTSA'S EVALUATION OF AIR CUSHION RESTRAINT SYSTEM EFFECTIVENESS (ACRS)

HS-016 579

### ACTIVE

AN OBJECTIVE ANALYSIS OF THE PROTECTION OFFERED BY ACTIVE AND PASSIVE RESTRAINT SYSTEMS

HS-016 693

### AERODYNAMIC

DRIVER-VEHICLE CONTROL AND PERFORMANCE IN THE PRESENCE OF AERODYNAMIC DISTURBANCES FROM LARGE VEHICLES

HS-016 651

### AIR

ELECTRONIC FAULT MONITORING AND DIAGNOSIS IN AIR BAG SYSTEMS

HS-016 535

NHTSA'S EVALUATION OF AIR CUSHION RESTRAINT SYSTEM EFFECTIVENESS (ACRS)

HS-016 579

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 1.- PROGRAM DEVELOPMENT

HS-016 587

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2- CRASH TESTING THE GENERAL MOTORS AIR CUSHION

HS-016 588

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 3- HUMAN VOLUNTEER TESTING

HS-016 589

THEORETICAL STUDY OF NONLINEAR MEMBRANE PROBLEMS WITH APPLICATIONS TO AIR BAGS. FINAL REPORT

HS-801 540

### ALCOHOL

ALCOHOL AND DRUGS

HS-016 667

ALCOHOL AND HEALTH. SECOND SPECIAL REPORT TO THE U. S. CONGRESS, JUNE 1974, FROM THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE. NEW KNOWLEDGE

HS-016 540

ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT

HS-801 435

ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT

HS-801 436

ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES; PHASE 1: HIGH RISK DRIVER STUDY PLAN. REPORT

HS-801 433

ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT ON PHASE 1

HS-801 434

THE ALCOHOL CRASH STORY: NEWS MEDIA GUIDE

HS-016 721

**ALCOHOLICS**

PERSONALITY AND TEMPERAMENT DIFFERENCES  
BETWEEN ALCOHOLICS WITH HIGH AND LOW  
RECORDS OF TRAFFIC ACCIDENTS AND VIOLA-  
TIONS

HS-016 696

**AMF/FIAT**

ANALYSIS OF TEST RESULTS FOR AMF/FIAT ESV  
HEAD-ON COLLISION

HS-016 601

**ANGLES**

MEASUREMENT OF TRANSIENT SLIP ANGLES OF  
TIRES--A CONTRIBUTION OF EVALUATING SAFETY-  
RELEVANT DRIVING CONDITIONS

HS-016 627

**ANTHROPOMORPHIC**

GM-ATD 502 ANTHROPOMORPHIC DUMMY--  
DEVELOPMENT AND EVALUATION

HS-016 586

**AORTIC**

NONLINEAR WAVE PROPAGATION IN  
VISCOELASTIC TUBES: APPLICATION TO AORTIC  
RUPTURE

HS-016 676

**ASSISTED**

ENVIRONMENTALLY ASSISTED FRACTURING:  
RESEARCH AND STANDARDS

HS-016 721

**ATD**

GM-ATD 502 ANTHROPOMORPHIC DUMMY--  
DEVELOPMENT AND EVALUATION

HS-016 586

**ATLANTA**

THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE  
AS A MODE OF TRANSPORTATION AND RECREA-  
TION. ATLANTA METROPOLITAN REGION

HS-016 517

THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE  
AS A MODE OF TRANSPORTATION AND RECREA-  
TION. ATLANTA METROPOLITAN REGION. TECHNI-  
CAL APPENDIX

HS-016 518

**AUTO**

AUTO ELECTRONICS: A SEMICONDUCTOR SUPPLI-  
ER'S VIEWPOINT

HS-016 523

**AUTOMOBILE**

A THEORETICAL AND EXPERIMENTAL INVESTIGA-  
TION OF AUTOMOBILE PATH DEVIATIONS WHEN  
DRIVER STEERS WITH NO VISUAL INPUT

HS-016 653

APPLICATION OF MICROPROCESSORS TO THE AU-  
TOMOBILE

HS-016 525

AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF  
WHEEL SPIN-DOWN AND OTHER VARIABLES.  
FINAL REPORT

HS-016 700

DEVELOPMENT AND MANUFACTURE OF AUTOMO-  
BILE BUMPERS

HS-016 621

ELECTRONIC DISPLAY SYSTEMS IN THE AUTOMO-  
BILE

HS-016 529

STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISION. VOL. 1. FINAL REPORT

HS-801 519

STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISIONS. VOL. 2. FINAL REPORT

HS-801 520

THE EFFECTS OF AUTOMOBILE SAFETY REGULA-  
TION

HS-016 511

**AUTOMOBILES**

AN OVERVIEW OF THE U.S. GOVERNMENT PRO-  
GRAM TO EVALUATE ALTERNATIVE POWER-  
PLANTS TO THE CONVENTIONAL INTERNAL COM-  
BUSTION ENGINES FOR AUTOMOBILES

HS-016 639

FIELD PERFORMANCE OF EMISSIONS-CON-  
TROLLED AUTOMOBILES. CONSULTANT REPORT  
TO THE COMMITTEE ON MOTOR VEHICLE EMIS-  
SIONS. COMMISSION ON SOCIOTECHNICAL  
SYSTEMS, NATIONAL RESEARCH COUNCIL

HS-016 514

HYDROGEN FUELED AUTOMOBILES

HS-016 725

**AVOIDANCE**

THE RELATION BETWEEN VEHICLE HANDLING  
AND ACCIDENT AVOIDANCE

HS-016 626

**BAG**

ELECTRONIC FAULT MONITORING AND DIAGNOSIS  
IN AIR BAG SYSTEMS

HS-016 535

**BAGS**

THEORETICAL STUDY OF NONLINEAR MEMBRANE  
PROBLEMS WITH APPLICATIONS TO AIR BAGS.  
FINAL REPORT

HS-801 540

**BAYFLEX**

BAYFLEX: A NEW MATERIAL FOR ELASTOMERIC  
BUMPERS AND BODY PARTS

HS-016 546

**BEAMS**

DEVELOPMENT OF A COMPUTER SIMULATION TO  
PREDICT THE VISIBILITY DISTANCE PROVIDED BY  
HEADLAMP BEAMS

HS-016 647

**BEHAVIOR**

A MODEL ANALYSIS OF THE STRUCTURAL AND  
PNEUMATIC CONTRIBUTIONS TO TIRE BEHAVIOR  
UNDER VERTICAL LOADS

HS-016 677

**BELT**

A CONTROLLED STUDY OF THE EFFECT OF  
TELEVISION MESSAGES ON SAFETY BELT USE



THE FORD AUTOMATIC SAFETY BELT SYSTEM	HS-016 398
	HS-016 607
<b>BELTS</b>	
LAP BELTS AND 3-POINT BELTS: A COMPARISON OF EFFECTIVENESS	
	HS-016 681
RELATIONSHIP BETWEEN VEHICLE FRONT-END DEFORMATION AND EFFICIENCY OF SAFETY BELTS DURING FRONTAL IMPACT	
	HS-016 606
<b>BENEFIT</b>	
COST-BENEFIT ANALYSIS OF BUMPER SYSTEMS FOR SMALL CARS	
	HS-016 644
<b>BENEFIT/COST</b>	
BENEFIT/COST ANALYSIS AS A BASIS FOR DECISIONS IN THE AUTOMOTIVE INDUSTRY	
	HS-016 641
<b>BICYCLE</b>	
THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE AS A MODE OF TRANSPORTATION AND RECREATION. ATLANTA METROPOLITAN REGION	
	HS-016 517
THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE AS A MODE OF TRANSPORTATION AND RECREATION. ATLANTA METROPOLITAN REGION. TECHNICAL APPENDIX	
	HS-016 518
<b>BILDACK</b>	
FAKTORER SOM MEDVERKAR TILL LAG FRIKTION MELLAN BILDACK OCH VAGBANA (FACTORS CONTRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)	
	HS-016 703
<b>BIOMECHANICAL</b>	
BIOMECHANICAL STUDY OF SIDE IMPACT ACCIDENTS	
	HS-016 592
<b>BIOMECHANICS</b>	
NHTSA PROGRAMS IN BIOMECHANICS	
	HS-016 585
<b>BLOOD</b>	
TRENDS IN BLOOD ALCOHOL CONCENTRATION LEVELS OF NIGHT DRIVERS	
	HS-016 654
<b>BODY</b>	
BAYFLEX: A NEW MATERIAL FOR ELASTOMERIC BUMPERS AND BODY PARTS	
	HS-016 546
CHARACTERISTICS OF BODY ENERGY ABSORPTION AND RESTRAINT SYSTEM	
	HS-016 623
SOME CONSIDERATIONS OF BODY STRUCTURE CRUSHABILITY IN RELATION TO IMPACT SPEED	
	HS-016 609
<b>BOUNDARIES</b>	
THE INFLUENCE OF WIND TUNNEL SOLID BOUNDARIES ON AUTOMOTIVE TEST DATA	
	HS-016 547
<b>BOX</b>	
DESIGN AND TEST OF PICKUP TRUCK BOX COVER	
	HS-016 545
<b>BRAKESAVER</b>	
BRAKESAVER -- CATERPILLAR'S HIGHWAY TRUCK RETARDER	
	HS-016 554
<b>BRAKING</b>	
FURTHER RESEARCH ON THE DRIVER/VEHICLE SYSTEM STUDY OF BRAKING IN A TURN	
	HS-016 630
IMPROVING DIRECTIONAL STABILITY UNDER BRAKING	
	HS-016 629
OPTIMALES ABBREMSEN EINES FAHRZEUGES BEI KURVENFAHRT (OPTIMAL VEHICLE BRAKING DURING A TURN)	
	HS-016 503
STEERABILITY DURING EMERGENCY BRAKING. SWEDISH ESV PROJECT	
	HS-016 571
<b>BRITISH</b>	
[THE SAFETY VEHICLE PROGRAM AT BRITISH LEYLAND MOTOR CORPORATION]	
	HS-016 567
BRITISH LEYLAND/TRRL EXPERIMENTAL SAFETY SYSTEMS CONTRACT	
	HS-016 566
<b>BRV</b>	
BASIC RESEARCH VEHICLE--RENAULT BRV	
	HS-016 562
<b>BUMPER</b>	
COST-BENEFIT ANALYSIS OF BUMPER SYSTEMS FOR SMALL CARS	
	HS-016 644
THE DUNLOP MK 2 COMPOSITE ENERGY ABSORBING BUMPER SYSTEM	
	HS-016 615
<b>BUMPERS</b>	
BAYFLEX: A NEW MATERIAL FOR ELASTOMERIC BUMPERS AND BODY PARTS	
	HS-016 546
DEVELOPMENT AND MANUFACTURE OF AUTOMOBILE BUMPERS	
	HS-016 621
<b>BUS</b>	
DEVELOPMENT OF A SCHOOL BUS FUEL SYSTEM INTEGRITY COMPLIANCE PROCEDURE. FINAL REPORT	
	HS-801 529

- TION BUS SERVICES** HS-016 538
- STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. TRUCK AND BUS PANEL REPORT NO. 7** HS-016 501
- CAB**
- CAB CONDITION -- HEATING AND COOLING-- HEAVY DUTY TRUCK AND OFF-HIGHWAY EQUIPMENT** HS-016 694
- CAR**
- ACCIDENT INVESTIGATION AS AN AID TO PLANNING THE FUTURE OF CAR SAFETY** HS-016 583
- BIG AND LITTLE CAR COMPATIBILITY** HS-016 602
- DEVELOPMENT OF AN ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT CAR DRIVERS. FINAL REPORT** HS-801 528
- EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE, CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR CRASHES** HS-016 577
- PASSENGER CAR AND LIGHT TRUCK SHOCK ABSORBER INSPECTION EQUIPMENT VOL. 1 -- SUMMARY REPORT. FINAL REPORT** HS-801 527
- PASSENGER CAR AND LIGHT TRUCK SHOCK ABSORBER INSPECTION EQUIPMENT. VOL. 2 -- TECHNICAL REPORT. FINAL REPORT** HS-801 530
- SOME PATTERNS AND CAUSES OF INJURY IN CAR OCCUPANTS** HS-016 584
- THE FUTURE FOR CAR SAFETY IN EUROPE. A REPORT OF THE EEVC** HS-016 561
- THE PUNCTURED PNEUMATIC CAR TIRE FROM THE USER'S VIEWPOINT** HS-016 635
- VEHICLE COMPATIBILITY IN CAR-TO-CAR SIDE IMPACTS AND PEDESTRIAN-TO-CAR FRONTAL IMPACTS** HS-016 612
- CARBON**
- EFFECTS OF CARBON MONOXIDE INTOXICATION ON DRIVING TASKS** HS-016 652
- CARBURETOR**
- CLOSED LOOP CARBURETOR EMISSION CONTROL SYSTEM** HS-016 533
- CAROLINA**
- AN ANALYSIS OF FARM EQUIPMENT ACCIDENTS ON NORTH CAROLINA PUBLIC ROADS** HS-016 499
- THEY WORK? NORTH CAROLINA SYMPOSIUM ON HIGHWAY SAFETY, RALEIGH, SPRING, 1974. VOL. 10** HS-016 648
- CARRIER**
- DEREGULATION: THE MOTOR CARRIER DESTRUCTION ACT OF 1975?** HS-016 679
- CARS**
- COST-BENEFIT ANALYSIS OF BUMPER SYSTEMS FOR SMALL CARS** HS-016 644
- CRITICAL ASSESSMENT OF SOCIAL AND ECONOMIC IMPLICATIONS OF SAFETY CARS** HS-016 556
- CATERPILLAR**
- BRAKESAVER -- CATERPILLAR'S HIGHWAY TRUCK RETARDER** HS-016 554
- CENTRED**
- PERSONALITY AND OTHER PERSON-CENTRED CHARACTERISTICS** HS-016 668
- CHAIN**
- MEASUREMENT OF AUTOMOTIVE TIMING CHAIN DRIVE LOADS** HS-016 548
- CHARGE**
- A TWO-CHARGE ENGINE CONCEPT: HYDROGEN ENRICHMENT** HS-016 688
- SINGLE-CYLINDER STUDY OF STRATIFIED CHARGE PROCESS WITH PRECHAMBER-INJECTION** HS-016 685
- THE ROLL OF CONNECTING NOZZLE AND THE FLAME INITIATION POINT IN THE PERFORMANCE OF A DUAL CHAMBER STRATIFIED CHARGE ENGINE** HS-016 689
- CHILD**
- THE HAMPSHIRE CHILD PEDESTRIAN ACCIDENT STUDY** HS-016 674
- CIRCULATION**
- TRAFFIC CIRCULATION PLANNING FOR COMMUNITIES** HS-016 712
- CITROEN**
- [CITROEN EXPERIMENTAL SAFETY VEHICLE PROGRAM]** HS-016 563
- CLEVELAND**
- DRIVER EDUCATION IN CLEVELAND PUBLIC AND NON-PUBLIC SCHOOLS AND APPENDICES (REFERENCES). UTILIZING PARAPROFESSIONAL PERSONNEL AS ROADWORK INSTRUCTORS** HS-016 509

## **COLLISION**

ANALYSIS OF TEST RESULTS FOR AMF/FIAT ESV  
HEAD-ON COLLISION

HS-016 601

REVIEWS ON ACCURACIES AND RESULTS OF ESV  
COLLISION TESTS

HS-016 622

STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISION. VOL. 1. FINAL REPORT

HS-801 519

## **COLLISIONS**

COMPATIBILITY BETWEEN VEHICLES IN FRONTAL  
AND SEMI-FRONTAL COLLISIONS

HS-016 605

STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISIONS. VOL. 2. FINAL REPORT

HS-801 520

## **COLUMN**

FACTORS INFLUENCING THE PERFORMANCE OF  
THE ENERGY ABSORBING STEERING COLUMN IN  
ACCIDENTS

HS-016 578

## **COMBUSTION**

AN OVERVIEW OF THE U.S. GOVERNMENT PRO-  
GRAM TO EVALUATE ALTERNATIVE POWER-  
PLANTS TO THE CONVENTIONAL INTERNAL COM-  
BUSTION ENGINES FOR AUTOMOBILES

HS-016 639

COMBUSTION CHARACTERISTICS OF THE TORCH  
IGNITED ENGINE

HS-016 686

EVOLUTION OF A NEW COMBUSTION SYSTEM FOR  
DIESEL EMISSION CONTROL

HS-016 683

FLAME PROPAGATION IN AN EDDY COMBUSTION  
CHAMBER

HS-016 690

## **COMMUNITIES**

TRAFFIC CIRCULATION PLANNING FOR COMMUNI-  
TIES

HS-016 712

## **COMPLIANCE**

DEVELOPMENT OF A SCHOOL BUS FUEL SYSTEM  
INTEGRITY COMPLIANCE PROCEDURE. FINAL RE-  
PORT

HS-801 529

## **COMPONENTS**

A LABORATORY FATIGUE TEST PROGRAM FOR  
STEERING COMPONENTS BASED ON FIELD LOAD  
DATA

HS-016 542

## **COMPUTER**

A COMPUTER-BASED SYSTEM FOR LICENSING EL-  
DERLY DRIVERS AND POSSIBLY OTHERS

HS-016 660

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 1.  
ENGINEERING MANUAL. FINAL REPORT

HS-801 507

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2.  
MODEL VALIDATION. FINAL REPORT

HS-801 508

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 3.  
USER MANUAL. FINAL REPORT

HS-801 509

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 4.  
PROGRAMMERS MANUAL. FINAL REPORT

HS-801 510

DESIGN CONSIDERATIONS FOR AN ON-BOARD  
COMPUTER SYSTEM

HS-016 527

DEVELOPMENT OF A COMPUTER SIMULATION TO  
PREDICT THE VISIBILITY DISTANCE PROVIDED BY  
HEADLAMP BEAMS

HS-016 647

ENGINE CONTROL BY AN ON-BOARD COMPUTER

HS-016 526

THE APPLICATION OF COMPUTER SIMULATIONS IN  
VEHICLE SAFETY

HS-016 613

## **CONCENTRATION**

TRENDS IN BLOOD ALCOHOL CONCENTRATION  
LEVELS OF NIGHT DRIVERS

HS-016 654

## **CONSCIOUS**

HOW CONSCIOUS ARE YOUR DRIVING HABITS?

HS-016 720

## **CONTACT**

CONTACT OF AN INFLATED TOROIDAL MEMBRANE  
WITH A FLAT SURFACE AS AN APPROACH TO THE  
TIRE DEFLECTION PROBLEM

HS-016 678

## **CONTROL**

BOSCH ELECTRONIC FUEL INJECTION WITH  
CLOSED LOOP CONTROL

HS-016 532

CLOSED LOOP CARBURETOR EMISSION CONTROL  
SYSTEM

HS-016 533

DRIVER-VEHICLE CONTROL AND PERFORMANCE  
IN THE PRESENCE OF AERODYNAMIC  
DISTURBANCES FROM LARGE VEHICLES

HS-016 651

ELECTRONIC OPTIMIZER CONTROL FOR I. C. EN-  
GINE: MOST MPG FOR ANY MPH

HS-016 534

EMISSIONS CONTROL OF ENGINE SYSTEMS. CON-  
SULTANT REPORT

HS-016 498

ENGINE CONTROL BY AN ON-BOARD COMPUTER

HS-016 526

EVOLUTION OF A NEW COMBUSTION SYSTEM FOR  
DIESEL EMISSION CONTROL

HS-016 683

FACTORS LEADING TO LOSS OF CONTROL--A

POSITIVE GUIDANCE IN TRAFFIC CONTROL	HS-016 698	EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE, CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR CRASHES	HS-016 577
<b>COOLING</b>		RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2-- CRASH TESTING THE GENERAL MOTORS AIR CUSHION	HS-016 588
CAB CONDITION -- HEATING AND COOLING-- HEAVY DUTY TRUCK AND OFF-HIGHWAY EQUIPMENT	HS-016 694	RESEARCH SAFETY VEHICLE CRASH EFFECTIVENESS METHODOLOGY	HS-016 640
<b>CORPORATION</b>		RSV, CRASH HAZARDS AND PUBLIC SUPPORT	HS-016 599
[THE SAFETY VEHICLE PROGRAM AT BRITISH LEYLAND MOTOR CORPORATION]	HS-016 567	STUDY OF POST-CRASH FACTORS IN AUTOMOBILE COLLISION. VOL. 1. FINAL REPORT	HS-801 519
<b>COST</b>		STUDY OF POST-CRASH FACTORS IN AUTOMOBILE COLLISIONS. VOL. 2. FINAL REPORT	HS-801 520
COST-BENEFIT ANALYSIS OF BUMPER SYSTEMS FOR SMALL CARS	HS-016 644	THE ALCOHOL CRASH STORY: NEWS MEDIA GUIDE	HS-016 731
COST-EFFECTIVENESS STUDY	HS-016 642	THE FREQUENCY OF CORRESPONDING VEHICLE DAMAGE IN CRASH TESTS AND ACTUAL ACCIDENTS	HS-016 582
<b>COSTS</b>		VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF A CRASH VICTIM -- EXTENSION AND VALIDATION STUDY. FINAL REPORT	HS-801 547
MANUFACTURABILITY AND COSTS OF PROPOSED LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS. CONSULTANT REPORT	HS-016 502	<b>CRASHER</b>	
<b>COUNTERMEASURES</b>		SUICIDAL CRASHER. WATCH OUT FOR THE WRONG WAY DRIVER...DEATH MAY BE HIS OBJECTIVE	HS-016 718
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT	HS-801 435	<b>CRASHES</b>	
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT	HS-801 436	EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE, CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR CRASHES	HS-016 577
ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES; PHASE 1: HIGH RISK DRIVER STUDY PLAN. REPORT	HS-801 433	<b>CRITERIA</b>	
ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT ON PHASE 1	HS-801 434	PHILOSOPHY, CRITERIA, AND METHODS OF DRIVER LICENSING	HS-016 656
CONCLUSIONS, COUNTERMEASURES AND FUTURE RESEARCH [YOUNG DRIVER ACCIDENTS]	HS-016 671	<b>CRUSHABILITY</b>	
<b>COVER</b>		SOME CONSIDERATIONS OF BODY STRUCTURE CRUSHABILITY IN RELATION TO IMPACT SPEED	HS-016 609
DESIGN AND TEST OF PICKUP TRUCK BOX COVER	HS-016 545	<b>CURB</b>	
<b>CRASH</b>		THE MECHANICS OF ROLLOVER AS THE RESULT OF CURB IMPACT	HS-016 537
AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 1. ENGINEERING MANUAL. FINAL REPORT	HS-801 507	<b>CURRICULUM</b>	
AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2. MODEL VALIDATION. FINAL REPORT	HS-801 508	SAFE PERFORMANCE CURRICULUM FOR SECONDARY SCHOOL DRIVER EDUCATION: PROGRAM DEVELOPMENT, IMPLEMENTATION, AND TECHNICAL FINDINGS. FINAL REPORT	HS-801 491
AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 3. USER MANUAL. FINAL REPORT	HS-801 509		
AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 4. PROGRAMMERS MANUAL. FINAL REPORT	HS-801 510		

- NHISA'S EVALUATION OF AIR CUSHION  
 RESTRAINT SYSTEM EFFECTIVENESS (ACRS)  
 HS-016 579
- RELATING AIR CUSHION PERFORMANCE TO  
 HUMAN FACTORS AND TOLERANCE LEVELS. PT. 1--  
 - PROGRAM DEVELOPMENT  
 HS-016 587
- RELATING AIR CUSHION PERFORMANCE TO  
 HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2--  
 CRASH TESTING THE GENERAL MOTORS AIR  
 CUSHION  
 HS-016 588
- RELATING AIR CUSHION PERFORMANCE TO  
 HUMAN FACTORS AND TOLERANCE LEVELS. PT. 3--  
 HUMAN VOLUNTEER TESTING  
 HS-016 589
- CYLINDER**  
 SINGLE-CYLINDER STUDY OF STRATIFIED CHARGE  
 PROCESS WITH PRECHAMBER-INJECTION  
 HS-016 685
- DAMAGE**  
 THE FREQUENCY OF CORRESPONDING VEHICLE  
 DAMAGE IN CRASH TESTS AND ACTUAL AC-  
 CIDENTS  
 HS-016 582
- DATSUN**  
 THE ECONOMICAL DESIGN OF THE DATSUN  
 PICKUP  
 HS-016 553
- DEADLY**  
 DEADLY DRIVING HABITS. 104 YEAR OLD  
 RESOLVES TO QUIT SPEEDING  
 HS-016 505
- DEATH**  
 DEATH OFTEN RIDES AT THE WHEEL OF THE  
 DROWSY DRIVER  
 HS-016 673
- SUICIDAL CRASHER. WATCH OUT FOR THE WRONG  
 WAY DRIVER...DEATH MAY BE HIS OBJECTIVE  
 HS-016 718
- DEFLATED**  
 STEERING AND HANDLING CHARACTERISTICS OF  
 A VEHICLE WHEN FAIL-SAFE TIRE IS DEFLATED  
 HS-016 637
- DEFLECTION**  
 CONTACT OF AN INFLATED TOROIDAL MEMBRANE  
 WITH A FLAT SURFACE AS AN APPROACH TO THE  
 TIRE DEFLECTION PROBLEM  
 HS-016 678
- DEFORMATION**  
 RELATIONSHIP BETWEEN VEHICLE FRONT-END  
 DEFORMATION AND EFFICIENCY OF SAFETY  
 BELTS DURING FRONTAL IMPACT  
 HS-016 606
- DENOVO**  
 SAFETY ASPECTS OF DENOVO RUN FLAT TIRES  
 HS-016 632
- DEREGULATION: THE MOTOR CARRIER DESTRUC-  
 TION ACT OF 1975?  
 HS-016 679
- DESTRUCTION**  
 DEREGULATION: THE MOTOR CARRIER DESTRUC-  
 TION ACT OF 1975?  
 HS-016 679
- DEVIATIONS**  
 A THEORETICAL AND EXPERIMENTAL INVESTIGA-  
 TION OF AUTOMOBILE PATH DEVIATIONS WHEN  
 DRIVER STEERS WITH NO VISUAL INPUT  
 HS-016 653
- DIAGNOSIS**  
 ELECTRONIC FAULT MONITORING AND DIAGNOSIS  
 IN AIR BAG SYSTEMS  
 HS-016 535
- DIAGNOSTIC**  
 A CASE FOR DIAGNOSTIC TESTS IN DRIVER EDU-  
 CATION  
 HS-016 659
- DIESEL**  
 EVOLUTION OF A NEW COMBUSTION SYSTEM FOR  
 DIESEL EMISSION CONTROL  
 HS-016 683
- DIESELIZATION**  
 DIESELIZATION OF LIGHT AND MEDIUM DUTY  
 COMMERCIAL VEHICLES IN JAPAN  
 HS-016 552
- DIFFERENCES**  
 PERSONALITY AND TEMPERAMENT DIFFERENCES  
 BETWEEN ALCOHOLICS WITH HIGH AND LOW  
 RECORDS OF TRAFFIC ACCIDENTS AND VIOLA-  
 TIONS  
 HS-016 696
- DIFFICULT**  
 DESIGN SOLUTIONS FOR TEMPERATURE SENSING  
 IN DIFFICULT AUTOMOTIVE APPLICATIONS  
 HS-016 550
- DIGITAL**  
 TECHNIQUES FOR DRIVING DIGITAL DISPLAYS  
 HS-016 531
- DIRECTIONAL**  
 IMPROVING DIRECTIONAL STABILITY UNDER  
 BRAKING  
 HS-016 629
- VERGLEICH EINIGER RECHEN- UND MESSERGE-  
 BNISSE ZUM FAHRVERHALTEN VON SATTELZUGEN  
 (COMPARISON OF SOME THEORETICAL AND EX-  
 PERIMENTAL RESULTS ON THE DIRECTIONAL  
 DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)  
 HS-016 504
- DISPLAY**  
 ELECTRONIC DISPLAY APPLICATIONS IN INSTRU-  
 MENT PANEL DESIGN  
 HS-016 530
- ELECTRONIC DISPLAY SYSTEMS IN THE AUTOMO-  
 BILE  
 HS-016 529

TECHNIQUES FOR DRIVING DIGITAL DISPLAYS	RESEARCH RECORD 520	HS-016 531	HS-016 650
<b>DISTANCE</b>			
DEVELOPMENT OF A COMPUTER SIMULATION TO PREDICT THE VISIBILITY DISTANCE PROVIDED BY HEADLAMP BEAMS		HS-016 647	
<b>DISTRIBUTION</b>			
FUNDAMENTALS OF AUTOMOTIVE ELECTRICAL DISTRIBUTION		HS-016 536	
<b>DISTURBANCES</b>			
DRIVER-VEHICLE CONTROL AND PERFORMANCE IN THE PRESENCE OF AERODYNAMIC DISTURBANCES FROM LARGE VEHICLES		HS-016 651	
<b>DRINKING</b>			
ONE TOO MANY FOR THE ROAD [DRINKING DRIVERS]		HS-016 512	
<b>DRIVE</b>			
FRONT WHEEL DRIVE IN AMERICA		HS-016 697	
MEASUREMENT OF AUTOMOTIVE TIMING CHAIN DRIVE LOADS		HS-016 548	
<b>DRIVER</b>			
A CASE FOR DIAGNOSTIC TESTS IN DRIVER EDUCATION		HS-016 659	
A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF AUTOMOBILE PATH DEVIATIONS WHEN DRIVER STEERS WITH NO VISUAL INPUT		HS-016 653	
ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES; PHASE 1: HIGH RISK DRIVER STUDY PLAN. REPORT		HS-801 433	
BASIC TRAINING PROGRAM FOR DRIVER LICENSE EXAMINERS: CONCEPTS AND RECOMMENDATIONS -- FINAL REPORT		HS-801 517	
CONCLUSIONS, COUNTERMEASURES AND FUTURE RESEARCH [YOUNG DRIVER ACCIDENTS]		HS-016 671	
DEATH OFTEN RIDES AT THE WHEEL OF THE DROWSY DRIVER		HS-016 673	
DETERMINATION OF MOTOR VEHICLE CHARACTERISTICS AFFECTING DRIVER HANDLING PERFORMANCE		HS-016 624	
DRIVER EDUCATION IN CLEVELAND PUBLIC AND NON-PUBLIC SCHOOLS AND APPENDICES (REFERENCES). UTILIZING PARAPROFESSIONAL PERSONNEL AS ROADWORK INSTRUCTORS		HS-016 509	
<b>DRIVER TRAINING</b>			
DRIVER-VEHICLE CONTROL AND PERFORMANCE IN THE PRESENCE OF AERODYNAMIC DISTURBANCES FROM LARGE VEHICLES		HS-016 651	
EXPOSURE AND EXPERIENCE [YOUNG DRIVER ACCIDENTS]		HS-016 665	
FUTURE ROLE OF DRIVER LICENSING IN HIGHWAY SAFETY		HS-016 655	
MICHIGAN DRIVER STATISTICS. REPORT NO. 7. JUNE 25, 1974		HS-016 716	
OVERVIEW OF NHTSA RESEARCH ACTIVITIES IN DRIVER EDUCATION AND LICENSING		HS-016 658	
PHILOSOPHY, CRITERIA, AND METHODS OF DRIVER LICENSING		HS-016 656	
SAFE PERFORMANCE CURRICULUM FOR SECONDARY SCHOOL DRIVER EDUCATION: PROGRAM DEVELOPMENT, IMPLEMENTATION, AND TECHNICAL FINDINGS. FINAL REPORT		HS-801 491	
SUICIDAL CRASHER. WATCH OUT FOR THE WRONG WAY DRIVER...DEATH MAY BE HIS OBJECTIVE		HS-016 718	
THE CHANGING TASK OF DRIVER LICENSING		HS-016 661	
YOU'RE A WHAT? [DRIVER EDUCATION]		HS-016 714	
YOUNG DRIVER ACCIDENTS. A REPORT PREPARED BY AN OECD ROAD RESEARCH GROUP		HS-016 663	
YOUNG DRIVER ACCIDENTS. APPENDICES.		HS-016 672	
<b>DRIVER/VEHICLE</b>			
DRIVER/VEHICLE RESPONSE RESEARCH		HS-016 625	
FURTHER RESEARCH ON THE DRIVER/VEHICLE SYSTEM STUDY OF BRAKING IN A TURN		HS-016 630	
<b>DRIVERS</b>			
A COMPUTER-BASED SYSTEM FOR LICENSING ELDERLY DRIVERS AND POSSIBLY OTHERS		HS-016 660	
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT		HS-801 435	
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT		HS-801 436	

DEVELOPMENT OF AN ADVANCED PASSIVE  
RESTRANT SYSTEM FOR SUBCOMPACT CAR  
DRIVERS. FINAL REPORT

HS-801 528

DRIVERS' LIMITATIONS

HS-016 634

ONE TOO MANY FOR THE ROAD [DRINKING  
DRIVERS]

HS-016 512

PROD: CARING FOR DRIVERS

HS-016 507

TRENDS IN BLOOD ALCOHOL CONCENTRATION  
LEVELS OF NIGHT DRIVERS

HS-016 654

YOUNG DRIVERS: THE PROBLEM

HS-016 664

## DRIVING

DEADLY DRIVING HABITS. 104 YEAR OLD  
RESOLVES TO QUIT SPEEDING

HS-016 505

EFFECTS OF CARBON MONOXIDE INTOXICATION  
ON DRIVING TASKS

HS-016 652

EVALUATION OF TIRE ABRASION IN TERMS OF  
DRIVING SEVERITY

HS-016 706

HOW CONSCIOUS ARE YOUR DRIVING HABITS?

HS-016 720

MEASUREMENT OF TRANSIENT SLIP ANGLES OF  
TIRES--A CONTRIBUTION OF EVALUATING SAFETY-  
RELEVANT DRIVING CONDITIONS

HS-016 627

TECHNIQUES FOR DRIVING DIGITAL DISPLAYS

HS-016 531

## DROWSY

DEATH OFTEN RIDES AT THE WHEEL OF THE  
DROWSY DRIVER

HS-016 673

## DRUGS

ALCOHOL AND DRUGS

HS-016 667

## DUMMIES

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON  
A MOCK VEHICLE EXTERIOR. FINAL REPORT

HS-801 544

## DUMMY

EVALUATION OF SEAT BELT SYSTEM AND DUMMY  
CHARACTERISTICS

HS-016 598

GM-ATD 502 ANTHROPOMORPHIC DUMMY--  
DEVELOPMENT AND EVALUATION

HS-016 586

HUMAN INJURY TOLERANCE LEVEL DETERMINA-  
TION FROM ACCIDENT DATA USING THE OPAT  
DUMMY

HS-016 590

PERFORMANCE MEASUREMENTS ON THE OPAT  
DUMMY

HS-016 594

THE DEVELOPMENT OF THE OPAT DUMMY

HS-016 593

## DUNLOP

THE DUNLOP MK 2 COMPOSITE ENERGY ABSORB-  
ING BUMPER SYSTEM

HS-016 615

## DUPLEX

ENERGY ABSORPTION BY VARIABLE SHEAR  
STRENGTH DUPLEX MATERIALS

HS-016 616

## DYNAMICS

VERGLEICH EINIGER RECHEN- UND MESSERGEB-  
NISSE ZUM FAHRVERHALTER VON SATTELZUGEN  
(COMPARISON OF SOME THEORETICAL AND EX-  
PERIMENTAL RESULTS ON THE DIRECTIONAL  
DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)

HS-016 504

## ECONOMIC

CRITICAL ASSESSMENT OF SOCIAL AND  
ECONOMIC IMPLICATIONS OF SAFETY CARS

HS-016 556

## ECONOMICAL

THE ECONOMICAL DESIGN OF THE DATSUN  
PICKUP

HS-016 553

## ECONOMY

DESIGN AND OPERATION OF EUROPEAN TRUCKS  
FOR MAXIMUM FUEL ECONOMY

HS-016 691

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. SAFETY IMPLICATIONS  
PANEL REPORT NO. 2

HS-016 500

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. TRUCK AND BUS  
PANEL REPORT NO. 7

HS-016 501

## EDDY

FLAME PROPAGATION IN AN EDDY COMBUSTION  
CHAMBER

HS-016 690

## EDUCATION

A CASE FOR DIAGNOSTIC TESTS IN DRIVER EDU-  
CATION

HS-016 659

ALCOHOL AND HEALTH. SECOND SPECIAL REPORT  
TO THE U. S. CONGRESS, JUNE 1974, FROM THE  
SECRETARY OF HEALTH, EDUCATION, AND WEL-  
FARE. NEW KNOWLEDGE

HS-016 540

DRIVER EDUCATION IN CLEVELAND PUBLIC AND  
NON-PUBLIC SCHOOLS AND APPENDICES  
(REFERENCES). UTILIZING PARAPROFESSIONAL  
PERSONNEL AS ROADWORK INSTRUCTORS

HS-016 509

OVERVIEW OF NHTSA RESEARCH ACTIVITIES IN  
DRIVER EDUCATION AND LICENSING

HS-016 658

CAL FINDINGS. FINAL REPORT	HS-801 491	CRASH VIEWPOINT	HS-016 523
YOU'RE A WHAT? [DRIVER EDUCATION]	HS-016 714	AUTOMOTIVE ELECTRONICS 2	HS-016 519
<b>EEVC</b>		PROGRESS IN AUTOMOTIVE ELECTRONICS	HS-016 520
THE FUTURE FOR CAR SAFETY IN EUROPE. A REPORT OF THE EEVC	HS-016 561	<b>EMERGENCY</b>	
<b>EFFICIENCY</b>		EMERGENCY CARE AND TRANSPORTATION OF THE SICK AND INJURED	HS-016 713
RELATIONSHIP BETWEEN VEHICLE FRONT-END DEFORMATION AND EFFICIENCY OF SAFETY BELTS DURING FRONTAL IMPACT	HS-016 606	EMERGENCY SERVICES. WHAT POTENTIAL FOR HELICOPTERS IN EMS?	HS-016 701
<b>EINIGER</b>		STEERABILITY DURING EMERGENCY BRAKING. SWEDISH ESV PROJECT	HS-016 571
VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTEN VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON THE DIRECTIONAL DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)	HS-016 504	<b>EMISSION</b>	
<b>ELASTOMERIC</b>		CLOSED LOOP CARBURETOR EMISSION CONTROL SYSTEM	HS-016 533
BAYFLEX: A NEW MATERIAL FOR ELASTOMERIC BUMPERS AND BODY PARTS	HS-016 546	EVOLUTION OF A NEW COMBUSTION SYSTEM FOR DIESEL EMISSION CONTROL	HS-016 683
<b>ELDERLY</b>		PROGRESS IN THE IMPLEMENTATION OF MOTOR VEHICLE EMISSION STANDARDS THROUGH JUNE 1974. REPORT TO CONGRESS	HS-016 702
A COMPUTER-BASED SYSTEM FOR LICENSING ELDERLY DRIVERS AND POSSIBLY OTHERS	HS-016 660	RECOMMENDED U.S. AUTOMOTIVE EMISSION STANDARDS	HS-016 711
<b>ELECTRICAL</b>		<b>EMISSIONS</b>	
FUNDAMENTALS OF AUTOMOTIVE ELECTRICAL DISTRIBUTION	HS-016 536	EMISSIONS CONTROL OF ENGINE SYSTEMS. CONSULTANT REPORT	HS-016 498
<b>ELECTRONIC</b>		FIELD PERFORMANCE OF EMISSIONS-CONTROLLED AUTOMOBILES. CONSULTANT REPORT TO THE COMMITTEE ON MOTOR VEHICLE EMISSIONS. COMMISSION ON SOCIOTECHNICAL SYSTEMS, NATIONAL RESEARCH COUNCIL	HS-016 514
BOSCH ELECTRONIC FUEL INJECTION WITH CLOSED LOOP CONTROL	HS-016 532	MANUFACTURABILITY AND COSTS OF PROPOSED LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS. CONSULTANT REPORT	HS-016 502
ELECTRONIC DISPLAY APPLICATIONS IN INSTRUMENT PANEL DESIGN	HS-016 530	<b>EMPIRICAL</b>	
ELECTRONIC DISPLAY SYSTEMS IN THE AUTOMOBILE	HS-016 529	EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE, CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR CRASHES	HS-016 577
ELECTRONIC EQUIPMENT EARNING ITS PLACE ON EUROPEAN VEHICLES	HS-016 521	<b>EMS</b>	
ELECTRONIC EQUIPMENT USAGE ON JAPANESE VEHICLES	HS-016 522	EMERGENCY SERVICES. WHAT POTENTIAL FOR HELICOPTERS IN EMS?	HS-016 701
ELECTRONIC FAULT MONITORING AND DIAGNOSIS IN AIR BAG SYSTEMS	HS-016 535	<b>ENERGY</b>	
ELECTRONIC OPTIMIZER CONTROL FOR I. C. ENGINE: MOST MPG FOR ANY MPH	HS-016 534	A PRACTICAL APPROACH TO THE PROTECTION OF MOTOR VEHICLES BY THE ABSORPTION [ABSORPTION] OF IMPACT ENERGY	HS-016 620
SURVEY OF ELECTRONIC DISPLAYS	HS-016 528		



AN AID ANALYSIS OF TEXAS TRAFFIC ACCIDENT DATA BEFORE AND DURING THE ENERGY CRISIS.	HS-016 610	
CHARACTERISTICS OF BODY ENERGY ABSORPTION AND RESTRAINT SYSTEM	HS-016 682	
ENERGY ABSORPTION BY VARIABLE SHEAR STRENGTH DUPLEX MATERIALS	HS-016 623	
FACTORS INFLUENCING THE PERFORMANCE OF THE ENERGY ABSORBING STEERING COLUMN IN ACCIDENTS	HS-016 616	
FRONT ENERGY MANAGEMENT PARAMETRIC VARIATION STUDY	HS-016 578	
SOME METHODS OF ABSORBING THE ENERGY OF MOTOR VEHICLES AND THEIR OCCUPANTS	HS-016 611	
THE DUNLOP MK 2 COMPOSITE ENERGY ABSORBING BUMPER SYSTEM	HS-016 615	
THE EVALUATION OF SAFETY, ENERGY, AND ENVIRONMENTAL FACTORS IN THE AUTOMOTIVE TRANSPORTATION SYSTEM	HS-016 638	
THE ROLE OF EXTRUSION DEVICES IN ENERGY ABSORPTION FOR SAFETY	HS-016 614	
TRAFFIC FATALITIES AND THE ENERGY CRISIS: A SECOND FOUR MONTH ANALYSIS MAY - AUG 1974	HS-016 732	
<b>ENGINE</b>		
A TWO-CHARGE ENGINE CONCEPT: HYDROGEN ENRICHMENT	HS-016 688	
COMBUSTION CHARACTERISTICS OF THE TORCH IGNITED ENGINE	HS-016 686	
ELECTRONIC OPTIMIZER CONTROL FOR I. C. ENGINE: MOST MPG FOR ANY MPH	HS-016 534	
EMISSIONS CONTROL OF ENGINE SYSTEMS. CONSULTANT REPORT	HS-016 498	
ENGINE CONTROL BY AN ON-BOARD COMPUTER	HS-016 526	
ENGINE DESIGN FOR THE FUTURE	HS-016 555	
ENGINE SILENCING--CHANGES IN EMPHASIS	HS-016 513	
MANUFACTURABILITY AND COSTS OF PROPOSED LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS. CONSULTANT REPORT	HS-016 502	
THE ROLL OF CONNECTING NOZZLE AND THE FLAME INITIATION POINT IN THE PERFORMANCE		
<b>ENGINES</b>		
AN OVERVIEW OF THE U.S. GOVERNMENT PROGRAM TO EVALUATE ALTERNATIVE POWER-PLANTS TO THE CONVENTIONAL INTERNAL COMBUSTION ENGINES FOR AUTOMOBILES	HS-016 639	
<b>ENGLAND</b>		
INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), LONDON, ENGLAND, JUNE 4-7, 1974	HS-016 557	
<b>ENRICHMENT</b>		
A TWO-CHARGE ENGINE CONCEPT: HYDROGEN ENRICHMENT	HS-016 688	
<b>ENVIRONMENTAL</b>		
THE EVALUATION OF SAFETY, ENERGY, AND ENVIRONMENTAL FACTORS IN THE AUTOMOTIVE TRANSPORTATION SYSTEM	HS-016 638	
<b>ENVIRONMENTALLY</b>		
ENVIRONMENTALLY ASSISTED FRACTURING: RESEARCH AND STANDARDS	HS-016 721	
<b>ENVIRONMENTS</b>		
SPECIFICATION AND SIMULATION OF PYROTECHNIC ENVIRONMENTS	HS-016 541	
<b>EQUIPMENT</b>		
AN ANALYSIS OF FARM EQUIPMENT ACCIDENTS ON NORTH CAROLINA PUBLIC ROADS	HS-016 499	
CAB CONDITION -- HEATING AND COOLING--HEAVY DUTY TRUCK AND OFF-HIGHWAY EQUIPMENT	HS-016 694	
ELECTRONIC EQUIPMENT EARNING ITS PLACE ON EUROPEAN VEHICLES	HS-016 521	
ELECTRONIC EQUIPMENT USAGE ON JAPANESE VEHICLES	HS-016 522	
PASSENGER CAR AND LIGHT TRUCK SHOCK ABSORBER INSPECTION EQUIPMENT VOL. 1 -- SUMMARY REPORT. FINAL REPORT	HS-801 527	
PASSENGER CAR AND LIGHT TRUCK SHOCK ABSORBER INSPECTION EQUIPMENT. VOL. 2 -- TECHNICAL REPORT. FINAL REPORT	HS-801 530	
SAFETY AND MOTOR VEHICLE EQUIPMENT	HS-016 628	
<b>ESV</b>		
ANALYSIS OF TEST RESULTS FOR AMF/FIAT ESV HEAD-ON COLLISION	HS-016 601	

PURSUANT TO THE ESV PROGRAM	HS-016 645
CHARACTERISTICS OF JAPANESE ESV TIRES	HS-016 636
EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS. PT. 1. UNITED STATES [ESV TESTING]	HS-016 559
REVIEWS ON ACCURACIES AND RESULTS OF ESV COLLISION TESTS	HS-016 622
STEERABILITY DURING EMERGENCY BRAKING. SWEDISH ESV PROJECT	HS-016 571
THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (SUMMARY OF TOYOTA ESV TEST)	HS-016 573
THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (SUMMARY OF NISSAN ESV TEST)	HS-016 574
<b>ESVW</b>	
THE ESVW 2. VOLKSWAGEN'S EXPERIMENTAL SAFETY VEHICLE	HS-016 565
<b>EUROPE</b>	
THE FUTURE FOR CAR SAFETY IN EUROPE. A REPORT OF THE EEVC	HS-016 561
<b>EUROPEAN</b>	
DESIGN AND OPERATION OF EUROPEAN TRUCKS FOR MAXIMUM FUEL ECONOMY	HS-016 691
ELECTRONIC EQUIPMENT EARNING ITS PLACE ON EUROPEAN VEHICLES	HS-016 521
EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS. PT. 2. EUROPEAN EXPERIMENTAL VEHICLES COMMITTEE	HS-016 560
<b>EXAMINERS</b>	
BASIC TRAINING PROGRAM FOR DRIVER LICENSE EXAMINERS: CONCEPTS AND RECOMMENDATIONS -- FINAL REPORT	HS-801 517
<b>EXPERIMENT</b>	
THE PHYSICS OF TIRE TRACTION. THEORY AND EXPERIMENT	HS-016 516
<b>EXPOSURE</b>	
EXPOSURE AND EXPERIENCE [YOUNG DRIVER ACCIDENTS]	HS-016 665
<b>EXTENSION</b>	
VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF A CRASH VICTIM -- EXTENSION AND VALIDATION STUDY. FINAL REPORT	HS-801 547
VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON A MOCK VEHICLE EXTERIOR. FINAL REPORT	HS-801 544
VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 2 -- ANALYSIS OF ACCIDENT INFORMATION. FINAL REPORT	HS-801 542
VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON A MOCK VEHICLE EXTERIOR. FINAL REPORT	HS-801 544
VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF A CRASH VICTIM -- EXTENSION AND VALIDATION STUDY. FINAL REPORT	HS-801 547
<b>EXTRUSION</b>	
THE ROLE OF EXTRUSION DEVICES IN ENERGY ABSORPTION FOR SAFETY	HS-016 614
<b>FAHRVERHALTER</b>	
VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTER VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON THE DIRECTIONAL DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)	HS-016 504
<b>FAHRZEUGES</b>	
OPTIMALES ABBREMSEN EINES FAHRZEUGES BEI KURVENFAHRT (OPTIMAL VEHICLE BRAKING DURING A TURN)	HS-016 503
<b>FAIL</b>	
STEERING AND HANDLING CHARACTERISTICS OF A VEHICLE WHEN FAIL-SAFE TIRE IS DEFLATED	HS-016 637
<b>FAILURE</b>	
LARGE-TRUCK ACCIDENTS INVOLVING TIRE FAILURE	HS-016 515
<b>FAKTORER</b>	
FAKTORER SOM MEDVERKAR TILL LAG FRIKTION MELLAN BILDACK OCH VAGBANA (FACTORS CONTRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)	HS-016 703
<b>FARM</b>	
AN ANALYSIS OF FARM EQUIPMENT ACCIDENTS ON NORTH CAROLINA PUBLIC ROADS	HS-016 499
<b>FATALITIES</b>	
TRAFFIC FATALITIES AND THE ENERGY CRISIS: A SECOND FOUR MONTH ANALYSIS MAY - AUG 1974	HS-016 732

A LABORATORY FATIGUE TEST PROGRAM FOR STEERING COMPONENTS BASED ON FIELD LOAD DATA	HS-016 542	THE FREQUENCY OF CORRESPONDING VEHICLE DAMAGE IN CRASH TESTS AND ACTUAL ACCIDENTS	HS-016 582
READING THE HIGHWAY...FIGHTING FATIGUE	HS-016 508	<b>FRICITION</b>	
<b>FAULT</b>		FAKTORER SOM MEDVERKAR TILL LAG FRIKTION MELLAN BILDACK OCH VAGBANA (FACTORS CONTRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)	HS-016 703
ELECTRONIC FAULT MONITORING AND DIAGNOSIS IN AIR BAG SYSTEMS	HS-016 535	<b>FRIKTION</b>	
<b>FEASIBILITY</b>		FAKTORER SOM MEDVERKAR TILL LAG FRIKTION MELLAN BILDACK OCH VAGBANA (FACTORS CONTRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)	HS-016 703
A FEASIBILITY STUDY ON SMALL SAFETY VEHICLES	HS-016 643	<b>FRONT</b>	
FEASIBILITY STUDY OF IN-VEHICLE WARNING SYSTEMS. FINAL REPORT	HS-801 569	FRONT ENERGY MANAGEMENT PARAMETRIC VARIATION STUDY	HS-016 600
<b>FEDERAL</b>		FRONT WHEEL DRIVE IN AMERICA	HS-016 697
FOR MORE SAFETY ON OUR ROADS. THE ROAD SAFETY PROGRAMME (PROGRAM) OF THE FEDERAL REPUBLIC OF GERMANY. "PEOPLE HAVE THE RIGHT OF WAY"	HS-016 539	RELATIONSHIP BETWEEN VEHICLE FRONT-END DEFORMATION AND EFFICIENCY OF SAFETY BELTS DURING FRONTAL IMPACT	HS-016 606
<b>FIAT</b>		<b>FRONTAL</b>	
FIAT TECHNICAL PRESENTATION	HS-016 570	COMPATIBILITY BETWEEN VEHICLES IN FRONTAL AND SEMI-FRONTAL COLLISIONS	HS-016 605
<b>FLAME</b>		OCCUPANT PROTECTION IN FRONTAL IMPACT (PASSIVE RESTRAINT), REAR IMPACT AND ROLLOVER	HS-016 568
FLAME PROPAGATION IN AN EDDY COMBUSTION CHAMBER	HS-016 690	OCCUPANT PROTECTION IN FRONTAL IMPACTS: A STATIC, PASSIVE RESTRAINT SYSTEM	HS-016 617
THE ROLL OF CONNECTING NOZZLE AND THE FLAME INITIATION POINT IN THE PERFORMANCE OF A DUAL CHAMBER STRATIFIED CHARGE ENGINE	HS-016 689	RELATIONSHIP BETWEEN VEHICLE FRONT-END DEFORMATION AND EFFICIENCY OF SAFETY BELTS DURING FRONTAL IMPACT	HS-016 606
<b>FLEET</b>		VEHICLE COMPATIBILITY IN CAR-TO-CAR SIDE IMPACTS AND PEDESTRIAN-TO-CAR FRONTAL IMPACTS	HS-016 612
PAST AND CONTEMPORARY TRENDS OF COMMERCIAL VEHICLES IN JAPAN AS VIEWED BY FLEET OWNER	HS-016 551	<b>FUEL</b>	
<b>FLEXIBLE</b>		BOSCH ELECTRONIC FUEL INJECTION WITH CLOSED LOOP CONTROL	HS-016 532
FLEXIBLE EXTERIOR AUTOMOTIVE TRIM	HS-016 603	DESIGN AND OPERATION OF EUROPEAN TRUCKS FOR MAXIMUM FUEL ECONOMY	HS-016 691
<b>FORD</b>		DEVELOPMENT OF A SCHOOL BUS FUEL SYSTEM INTEGRITY COMPLIANCE PROCEDURE. FINAL REPORT	HS-801 529
THE FORD AUTOMATIC SAFETY BELT SYSTEM	HS-016 607	EFFECTS OF TIRE ROLLING RESISTANCE ON VEHICLE FUEL CONSUMPTION	HS-016 675
<b>FRACTURING</b>			
ENVIRONMENTALLY ASSISTED FRACTURING: RESEARCH AND STANDARDS	HS-016 721		
<b>FRANCE</b>			
SYNTHESIS OF STATISTICAL DATA ON TRAFFIC ACCIDENTS IN FRANCE, WEST GERMANY, ITALY AND UNITED KINGDOM	HS-016 580		

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. SAFETY IMPLICATIONS  
PANEL REPORT NO. 2 HS-016 500

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. TRUCK AND BUS  
PANEL REPORT NO. 7 HS-016 501

**FUELED**  
HYDROGEN FUELED AUTOMOBILES HS-016 725

**FUNDAMENTALS**  
FUNDAMENTALS OF AUTOMOTIVE ELECTRICAL DISTRIBUTION HS-016 536

**GERMANY**  
FOR MORE SAFETY ON OUR ROADS. THE ROAD SAFETY PROGRAMME (PROGRAM) OF THE FEDERAL REPUBLIC OF GERMANY. "PEOPLE HAVE THE RIGHT OF WAY" HS-016 539

SYNTHESIS OF STATISTICAL DATA ON TRAFFIC ACCIDENTS IN FRANCE, WEST GERMANY, ITALY AND UNITED KINGDOM HS-016 580

**GM**  
GM-ATD 502 ANTHROPOMORPHIC DUMMY-- DEVELOPMENT AND EVALUATION HS-016 586

**GOVERNMENT**  
AN OVERVIEW OF THE U.S. GOVERNMENT PROGRAM TO EVALUATE ALTERNATIVE POWER-PLANTS TO THE CONVENTIONAL INTERNAL COMBUSTION ENGINES FOR AUTOMOBILES HS-016 639

**GOVERNOR**  
THINKING TWICE ABOUT HIGHWAY SAFETY. [WISCONSIN] GOVERNOR'S CONFERENCE ON HIGHWAY SAFETY IMPROVEMENT HS-016 680

**GUIDANCE**  
POSITIVE GUIDANCE IN TRAFFIC CONTROL HS-016 698

**HABITS**  
DEADLY DRIVING HABITS. 104 YEAR OLD RESOLVES TO QUIT SPEEDING HS-016 505

HOW CONSCIOUS ARE YOUR DRIVING HABITS? HS-016 720

**HAMPSHIRE**  
THE HAMPSHIRE CHILD PEDESTRIAN ACCIDENT STUDY HS-016 674

**HANDLING**  
DETERMINATION OF MOTOR VEHICLE CHARACTERISTICS AFFECTING DRIVER HANDLING PERFORMANCE HS-016 624

STEERING AND HANDLING CHARACTERISTICS OF A VEHICLE WHEN FAIL-SAFE TIRE IS DEFLATED HS-016 637

THE RELATION BETWEEN VEHICLE HANDLING AND ACCIDENT AVOIDANCE HS-016 626

THE ROLE OF VEHICLE HANDLING IN ACCIDENT CAUSATION HS-016 692

**HAZARDS**  
RSV, CRASH HAZARDS AND PUBLIC SUPPORT HS-016 599

**HEAD**  
ANALYSIS OF TEST RESULTS FOR AMF/FIAT ESV HEAD-ON COLLISION HS-016 601

**HEADLAMP**  
DEVELOPMENT OF A COMPUTER SIMULATION TO PREDICT THE VISIBILITY DISTANCE PROVIDED BY HEADLAMP BEAMS HS-016 647

**HEALTH**  
ALCOHOL AND HEALTH. SECOND SPECIAL REPORT TO THE U. S. CONGRESS, JUNE 1974, FROM THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE. NEW KNOWLEDGE HS-016 540

**HEATING**  
CAB CONDITION -- HEATING AND COOLING-- HEAVY DUTY TRUCK AND OFF-HIGHWAY EQUIPMENT HS-016 694

**HELICOPTERS**  
EMERGENCY SERVICES. WHAT POTENTIAL FOR HELICOPTERS IN EMS? HS-016 701

**HIGHWAY**  
BRAKESAVER -- CATERPILLAR'S HIGHWAY TRUCK RETARDER HS-016 554

CAB CONDITION -- HEATING AND COOLING-- HEAVY DUTY TRUCK AND OFF-HIGHWAY EQUIPMENT HS-016 694

FUTURE ROLE OF DRIVER LICENSING IN HIGHWAY SAFETY HS-016 655

HIGHWAY SAFETY PROGRAM EVALUATION AND RESEARCH HS-016 724

HIGHWAY SAFETY PROGRAMS: HOW DO WE KNOW THEY WORK? NORTH CAROLINA SYMPOSIUM ON HIGHWAY SAFETY, RALEIGH, SPRING, 1974. VOL. 10 HS-016 648

READING THE HIGHWAY...FIGHTING FATIGUE HS-016 508

THINKING TWICE ABOUT HIGHWAY SAFETY. [WISCONSIN] GOVERNOR'S CONFERENCE ON HIGHWAY SAFETY IMPROVEMENT HS-016 680

October 31, 1975

## **HINDRANCE**

DRIVER LICENSING LAW: HELP OR HINDRANCE?  
HS-016 657

## **HUMAN**

HUMAN INJURY TOLERANCE LEVEL DETERMINATION FROM ACCIDENT DATA USING THE OPAT DUMMY

HS-016 590

HUMAN TOLERANCE RESEARCH PROGRAM. FIRST YEAR INTERIM REPORT

HS-016 506

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 1. - PROGRAM DEVELOPMENT

HS-016 587

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2. - CRASH TESTING THE GENERAL MOTORS AIR CUSHION

HS-016 588

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 3. - HUMAN VOLUNTEER TESTING

HS-016 589

## **HYDRODYNAMICS**

HYDROPLANING AND TREAD PATTERN  
HYDRODYNAMICS

HS-016 646

## **HYDROGEN**

A TWO-CHARGE ENGINE CONCEPT: HYDROGEN ENRICHMENT

HS-016 688

HYDROGEN FUELED AUTOMOBILES

HS-016 725

## **HYDROPLANING**

AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF WHEEL SPIN-DOWN AND OTHER VARIABLES. FINAL REPORT

HS-016 700

HYDROPLANING AND TREAD PATTERN  
HYDRODYNAMICS

HS-016 646

## **IGNITED**

COMBUSTION CHARACTERISTICS OF THE TORCH IGNITED ENGINE

HS-016 686

## **IMPACT**

A PRACTICAL APPROACH TO THE PROTECTION OF MOTOR VEHICLES BY THE ABSORPTION [ABSORPTION] OF IMPACT ENERGY

HS-016 620

BIOMECHANICAL STUDY OF SIDE IMPACT ACCIDENTS

HS-016 592

OCCUPANT PROTECTION IN FRONTAL IMPACT (PASSIVE RESTRAINT), REAR IMPACT AND ROLLOVER

RELATIONSHIP BETWEEN VEHICLE FRONT-END DEFORMATION AND EFFICIENCY OF SAFETY BELTS DURING FRONTAL IMPACT

HS-016 606

SOME CONSIDERATIONS OF BODY STRUCTURE CRUSHABILITY IN RELATION TO IMPACT SPEED

HS-016 609

THE MECHANICS OF ROLLOVER AS THE RESULT OF CURB IMPACT

HS-016 537

## **IMPACTS**

OCCUPANT PROTECTION IN FRONTAL IMPACTS: A STATIC, PASSIVE RESTRAINT SYSTEM

HS-016 617

VEHICLE COMPATIBILITY IN CAR-TO-CAR SIDE IMPACTS AND PEDESTRIAN-TO-CAR FRONTAL IMPACTS

HS-016 612

## **INFLATED**

CONTACT OF AN INFLATED TOROIDAL MEMBRANE WITH A FLAT SURFACE AS AN APPROACH TO THE TIRE DEFLECTION PROBLEM

HS-016 678

## **INFLATION**

DEVELOPMENT OF IMPROVED INFLATION TECHNIQUES. TASK 3 -- SYSTEM PERFORMANCE EVALUATION. 15TH PROGRESS REPORT. 1 JANUARY TO 31 JANUARY 1975

HS-801 590

DEVELOPMENT OF IMPROVED INFLATION TECHNIQUES. TASK 3 -- SYSTEM PERFORMANCE EVALUATION. 16TH PROGRESS REPORT. 1 FEBRUARY TO 31 MARCH 1975

HS-801 591

## **INJECTION**

BOSCH ELECTRONIC FUEL INJECTION WITH CLOSED LOOP CONTROL

HS-016 532

SINGLE-CYLINDER STUDY OF STRATIFIED CHARGE PROCESS WITH PRECHAMBER-INJECTION

HS-016 685

## **INJURED**

EMERGENCY CARE AND TRANSPORTATION OF THE SICK AND INJURED

HS-016 713

## **INJURIES**

EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE, CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR CRASHES

HS-016 577

## **INJURY**

HUMAN INJURY TOLERANCE LEVEL DETERMINATION FROM ACCIDENT DATA USING THE OPAT DUMMY

HS-016 590

SOME PATTERNS AND CAUSES OF INJURY IN CAR OCCUPANTS

VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 2 -- ANALYSIS OF ACCIDENT INFORMATION. FINAL REPORT

HS-801 542

VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON A MOCK VEHICLE EXTERIOR. FINAL REPORT

HS-801 544

VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF A CRASH VICTIM -- EXTENSION AND VALIDATION STUDY. FINAL REPORT

HS-801 547

## INSPECTION

PASSENGER CAR AND LIGHT TRUCK SHOCK ABSORBER INSPECTION EQUIPMENT VOL. 1 -- SUMMARY REPORT. FINAL REPORT

HS-801 527

PASSENGER CAR AND LIGHT TRUCK SHOCK ABSORBER INSPECTION EQUIPMENT. VOL. 2 -- TECHNICAL REPORT. FINAL REPORT

HS-801 530

## INSTRUCTORS

DRIVER EDUCATION IN CLEVELAND PUBLIC AND NON-PUBLIC SCHOOLS AND APPENDICES (REFERENCES). UTILIZING PARAPROFESSIONAL PERSONNEL AS ROADWORK INSTRUCTORS

HS-016 509

## INSTRUMENT

ELECTRONIC DISPLAY APPLICATIONS IN INSTRUMENT PANEL DESIGN

HS-016 530

## INTEGRITY

DEVELOPMENT OF A SCHOOL BUS FUEL SYSTEM INTEGRITY COMPLIANCE PROCEDURE. FINAL REPORT

HS-801 529

## INTERFACING

A NEW INTERFACING CONCEPT: THE MONOLITHIC TEMPERATURE TRANSDUCER

HS-016 549

## INTERNAL

AN OVERVIEW OF THE U.S. GOVERNMENT PROGRAM TO EVALUATE ALTERNATIVE POWERPLANTS TO THE CONVENTIONAL INTERNAL COMBUSTION ENGINES FOR AUTOMOBILES

HS-016 639

## INTERSECTIONS

PRIORITY RULES AT UNCONTROLLED INTERSECTIONS

HS-016 649

## INTOXICATION

EFFECTS OF CARBON MONOXIDE INTOXICATION ON DRIVING TASKS

HS-016 652

## INVESTIGATIONS

FACTORS LEADING TO LOSS OF CONTROL--A GUIDE FROM ACCIDENT INVESTIGATIONS

## ITALY

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS. PT. 6. ITALY

HS-016 569

SYNTHESIS OF STATISTICAL DATA ON TRAFFIC ACCIDENTS IN FRANCE, WEST GERMANY, ITALY AND UNITED KINGDOM

HS-016 580

## JAPAN

DIESELIZATION OF LIGHT AND MEDIUM DUTY COMMERCIAL VEHICLES IN JAPAN

HS-016 552

PAST AND CONTEMPORARY TRENDS OF COMMERCIAL VEHICLES IN JAPAN AS VIEWED BY FLEET OWNER

HS-016 551

TRAFFIC ACCIDENTS IN JAPAN

HS-016 575

## JAPANESE

CHARACTERISTICS OF JAPANESE ESV TIRES

HS-016 636

ELECTRONIC EQUIPMENT USAGE ON JAPANESE VEHICLES

HS-016 522

THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (GENERAL DESCRIPTION)

HS-016 572

THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (SUMMARY OF TOYOTA ESV TEST)

HS-016 573

THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (SUMMARY OF NISSAN ESV TEST)

HS-016 574

## KNOWLEDGE

ALCOHOL AND HEALTH. SECOND SPECIAL REPORT TO THE U. S. CONGRESS, JUNE 1974, FROM THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE. NEW KNOWLEDGE

HS-016 540

## KURVENFAHRT

OPTIMALES ABREMSEN EINES FAHRZEUGES BEI KURVENFAHRT (OPTIMAL VEHICLE BRAKING DURING A TURN)

HS-016 503

## LACERATION

REDUCED LACERATION FROM A NEW LAMINATED WINDSHIELD

HS-016 597

## LAMINATED

REDUCED LACERATION FROM A NEW LAMINATED WINDSHIELD

HS-016 597

## LAMP

THE STOP LAMP: SOME OPTIMUM VISIBILITY CONSIDERATIONS

HS-016 631

## LAP

<b>LARGE</b> DRIVER-VEHICLE CONTROL AND PERFORMANCE IN THE PRESENCE OF AERODYNAMIC DISTURBANCES FROM LARGE VEHICLES	HS-016 651	<b>LIMITATIONS</b> DRIVERS' LIMITATIONS	HS-016 634
<b>LARGE-TRUCK</b> ACCIDENTS INVOLVING TIRE FAILURE	HS-016 515	<b>LITTLE</b> BIG AND LITTLE CAR COMPATIBILITY	HS-016 602
<b>LAW</b> DRIVER LICENSING LAW: HELP OR HINDRANCE?	HS-016 657	<b>LOAD</b> A LABORATORY FATIGUE TEST PROGRAM FOR STEERING COMPONENTS BASED ON FIELD LOAD DATA	HS-016 542
<b>LAWS</b> AGENDA FOR NATIONAL COMMITTEE MEETING (ON UNIFORM TRAFFIC LAWS AND ORDINANCES)	HS-016 695	<b>LOADS</b> A MODEL ANALYSIS OF THE STRUCTURAL AND PNEUMATIC CONTRIBUTIONS TO TIRE BEHAVIOR UNDER VERTICAL LOADS	HS-016 677
<b>LEADING</b> FACTORS LEADING TO LOSS OF CONTROL--A GUIDE FROM ACCIDENT INVESTIGATIONS	HS-016 633	<b>MEASUREMENT OF AUTOMOTIVE TIMING CHAIN DRIVE LOADS</b>	HS-016 548
<b>LEAN</b> VOLUME AND TEMPERATURE INFLUENCES ON THE EFFECTIVENESS OF LEAN THERMAL REAC- TORS	HS-016 687	<b>LONDON</b> INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), LON- DON, ENGLAND, JUNE 4-7, 1974	HS-016 557
<b>LEYLAND</b> [THE SAFETY VEHICLE PROGRAM AT BRITISH LEY- LAND MOTOR CORPORATION]	HS-016 567	<b>LOOP</b> BOOP ELECTRONIC FUEL INJECTION WITH CLOSED LOOP CONTROL	HS-016 532
<b>LEYLAND/TRRL</b> BRITISH LEYLAND/TRRL EXPERIMENTAL SAFETY SYSTEMS CONTRACT	HS-016 566	<b>CLOSED LOOP CARBURETOR EMISSION CONTROL SYSTEM</b>	HS-016 533
<b>LICENSE</b> BASIC TRAINING PROGRAM FOR DRIVER LICENSE EXAMINERS: CONCEPTS AND RECOMMENDATIONS -- FINAL REPORT	HS-801 517	<b>LOSS</b> FACTORS LEADING TO LOSS OF CONTROL--A GUIDE FROM ACCIDENT INVESTIGATIONS	HS-016 633
<b>LICENSING</b> A COMPUTER-BASED SYSTEM FOR LICENSING EL- DERLY DRIVERS AND POSSIBLY OTHERS	HS-016 660	<b>MANAGEMENT</b> FRONT ENERGY MANAGEMENT PARAMETRIC VARIATION STUDY	HS-016 600
<b>DRIVER LICENSING LAW: HELP OR HINDRANCE?</b>	HS-016 657	<b>MANUFACTURABILITY</b> MANUFACTURABILITY AND COSTS OF PROPOSED LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS. CONSULTANT REPORT	HS-016 502
<b>FUTURE ROLE OF DRIVER LICENSING IN HIGHWAY SAFETY</b>	HS-016 655	<b>MATERIAL</b> BAYFLEX: A NEW MATERIAL FOR ELASTOMERIC BUMPER AND BODY PARTS	HS-016 546
<b>IS THERE A SELECTION RATIO IN THE FUTURE OF LICENSING?</b>	HS-016 662	<b>MATERIALS</b> ENERGY ABSORPTION BY VARIABLE SHEAR STRENGTH DUPLEX MATERIALS	HS-016 616
<b>OVERVIEW OF NHTSA RESEARCH ACTIVITIES IN DRIVER EDUCATION AND LICENSING</b>	HS-016 658	<b>MEASUREMENT</b> MEASUREMENT OF AUTOMOTIVE TIMING CHAIN DRIVE LOADS	HS-016 548
<b>PHILOSOPHY, CRITERIA, AND METHODS OF DRIVER LICENSING</b>	HS-016 656		
<b>THE CHANGING TASK OF DRIVER LICENSING</b>	HS-016 661		

MEASUREMENT OF TRANSIENT SLIP ANGLES OF TIRES--A CONTRIBUTION OF EVALUATING SAFETY-RELEVANT DRIVING CONDITIONS	HS-016 627
<b>MEASUREMENTS</b>	
PERFORMANCE MEASUREMENTS ON THE OPAT DUMMY	HS-016 594
<b>MECHANICS</b>	
THE MECHANICS OF ROLLOVER AS THE RESULT OF CURB IMPACT	HS-016 537
<b>MEDIUM</b>	
DIESELIZATION OF LIGHT AND MEDIUM DUTY COMMERCIAL VEHICLES IN JAPAN	HS-016 552
<b>MEDVERKAR</b>	
FAKTORER SOM MEDVERKAR TILL LAG FRIKTION MELLAN BILDACK OCH VAGBANA (FACTORS CONTRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)	HS-016 703
<b>MELLAN</b>	
FAKTORER SOM MEDVERKAR TILL LAG FRIKTION MELLAN BILDACK OCH VAGBANA (FACTORS CONTRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)	HS-016 703
<b>MEMBRANE</b>	
CONTACT OF AN INFLATED TOROIDAL MEMBRANE WITH A FLAT SURFACE AS AN APPROACH TO THE TIRE DEFLECTION PROBLEM	HS-016 678
THEORETICAL STUDY OF NONLINEAR MEMBRANE PROBLEMS WITH APPLICATIONS TO AIR BAGS. FINAL REPORT	HS-801 540
<b>MESSAGES</b>	
A CONTROLLED STUDY OF THE EFFECT OF TELEVISION MESSAGES ON SAFETY BELT USE	HS-016 723
<b>MESSERGEBNISSE</b>	
VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTER VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON THE DIRECTIONAL DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)	HS-016 504
<b>METHODOLOGY</b>	
RESEARCH SAFETY VEHICLE CRASH EFFECTIVENESS METHODOLOGY	HS-016 640
<b>METROPOLITAN</b>	
THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE AS A MODE OF TRANSPORTATION AND RECREATION. ATLANTA METROPOLITAN REGION	HS-016 517
THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE AS A MODE OF TRANSPORTATION AND RECREATION. ATLANTA METROPOLITAN REGION. TECHNICAL APPENDIX	HS-016 518
<b>MICHIGAN</b>	
MICHIGAN DRIVER STATISTICS. REPORT NO. 7. JUNE 25, 1974	HS-016 716
<b>MICROPROCESSOR</b>	
WHAT IS A MICROPROCESSOR?	HS-016 524
<b>MICROPROCESSORS</b>	
APPLICATION OF MICROPROCESSORS TO THE AUTOMOBILE	HS-016 525
<b>MK</b>	
THE DUNLOP MK 2 COMPOSITE ENERGY ABSORBING BUMPER SYSTEM	HS-016 615
<b>MOCK</b>	
VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON A MOCK VEHICLE EXTERIOR. FINAL REPORT	HS-801 544
<b>MODEL</b>	
A MODEL ANALYSIS OF THE STRUCTURAL AND PNEUMATIC CONTRIBUTIONS TO TIRE BEHAVIOR UNDER VERTICAL LOADS	HS-016 677
AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2. MODEL VALIDATION. FINAL REPORT	HS-801 508
THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES) VOL. 1 EXECUTIVE SUMMARY. FINAL REPORT	HS-801 557
THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES). VOL. 2. TECHNICAL REPORT. FINAL REPORT	HS-801 558
THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES). VOLUME 3. LITERATURE SURVEY. FINAL REPORT	HS-801 559
<b>MODELS</b>	
A TECHNIQUE FOR THE VALIDATION OF VEHICLE MODELS USING THE ROAD SIMULATOR	HS-016 543
<b>MONITORING</b>	
ELECTRONIC FAULT MONITORING AND DIAGNOSIS IN AIR BAG SYSTEMS	HS-016 535
<b>MONOLITHIC</b>	
A NEW INTERFACING CONCEPT: THE MONOLITHIC TEMPERATURE TRANSDUCER	HS-016 549



**MOTOR**

[THE SAFETY VEHICLE PROGRAM AT BRITISH LEY-  
LAND MOTOR CORPORATION]

HS-016 567

A PRACTICAL APPROACH TO THE PROTECTION OF  
MOTOR VEHICLES BY THE ABSORPTION  
[ABSORPTION] OF IMPACT ENERGY

HS-016 620

DEREGULATION: THE MOTOR CARRIER DESTRUC-  
TION ACT OF 1975?

HS-016 679

DETERMINATION OF MOTOR VEHICLE CHARAC-  
TERISTICS AFFECTING DRIVER HANDLING PER-  
FORMANCE

HS-016 624

FIELD PERFORMANCE OF EMISSIONS-CON-  
TROLLED AUTOMOBILES. CONSULTANT REPORT  
TO THE COMMITTEE ON MOTOR VEHICLE EMIS-  
SIONS. COMMISSION ON SOCIOTECHNICAL  
SYSTEMS, NATIONAL RESEARCH COUNCIL

HS-016 514

PROGRESS IN THE IMPLEMENTATION OF MOTOR  
VEHICLE EMISSION STANDARDS THROUGH JUNE  
1974. REPORT TO CONGRESS

HS-016 702

SAFETY AND MOTOR VEHICLE EQUIPMENT

HS-016 628

SOME METHODS OF ABSORBING THE ENERGY OF  
MOTOR VEHICLES AND THEIR OCCUPANTS

HS-016 611

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. SAFETY IMPLICATIONS  
PANEL REPORT NO. 2

HS-016 500

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. TRUCK AND BUS  
PANEL REPORT NO. 7

HS-016 501

**MOTORCYCLE**

TAKE YOUR MOTORCYCLE ALONG

HS-016 715

**MOTORS**

RELATING AIR CUSHION PERFORMANCE TO  
HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2-  
CRASH TESTING THE GENERAL MOTORS AIR  
CUSHION

HS-016 588

**MULTIDISCIPLINARY**

MULTIDISCIPLINARY ACCIDENT INVESTIGATION  
SUMMARIES VOL. 5, NO. 3

HS-601 817

MULTIDISCIPLINARY ACCIDENT INVESTIGATION  
SUMMARIES VOL. 6, NO. 9

HS-801 496

MULTIDISCIPLINARY ACCIDENT INVESTIGATION  
SUMMARIES VOL. 6, NO. 7

HS-801 497

**MULTIPURPOSE**

A PROPOSED NEW NATIONAL SYSTEM FOR COL-  
LECTING MULTIPURPOSE ACCIDENT DATA: SIR

HS-016 576

**NATIONAL**

A PROPOSED NEW NATIONAL SYSTEM FOR COL-  
LECTING MULTIPURPOSE ACCIDENT DATA: SIR

HS-016 576

AGENDA FOR NATIONAL COMMITTEE MEETING  
(ON UNIFORM TRAFFIC LAWS AND ORDINANCES)

HS-016 695

FIELD PERFORMANCE OF EMISSIONS-CON-  
TROLLED AUTOMOBILES. CONSULTANT REPORT  
TO THE COMMITTEE ON MOTOR VEHICLE EMIS-  
SIONS. COMMISSION ON SOCIOTECHNICAL  
SYSTEMS, NATIONAL RESEARCH COUNCIL

HS-016 514

**NHTSA**

NHTSA PROGRAMS IN BIOMECHANICS

HS-016 585

NHTSA'S EVALUATION OF AIR CUSHION  
RESTRAINT SYSTEM EFFECTIVENESS (ACRS)

HS-016 579

OVERVIEW OF NHTSA RESEARCH ACTIVITIES IN  
DRIVER EDUCATION AND LICENSING

HS-016 658

**NIGHT**

TRENDS IN BLOOD ALCOHOL CONCENTRATION  
LEVELS OF NIGHT DRIVERS

HS-016 654

**NISSAN**

THE TEST OF JAPANESE EXPERIMENTAL VEHI-  
CLES (SUMMARY OF NISSAN ESV TEST)

HS-016 574

**NONLINEAR**

NONLINEAR WAVE PROPAGATION IN  
VISCOELASTIC TUBES: APPLICATION TO AORTIC  
RUPTURE

HS-016 676

THEORETICAL STUDY OF NONLINEAR MEMBRANE  
PROBLEMS WITH APPLICATIONS TO AIR BAGS.  
FINAL REPORT

HS-801 540

**NOZZLE**

THE ROLL OF CONNECTING NOZZLE AND THE  
FLAME INITIATION POINT IN THE PERFORMANCE  
OF A DUAL CHAMBER STRATIFIED CHARGE EN-  
GINE

HS-016 689

**OCCUPANT**

OCCUPANT PROTECTION DURING VEHICLE ROL-  
LOVER

HS-016 619

COVER HS-016 568  
 OCCUPANT PROTECTION IN FRONTAL IMPACTS: A  
 STATIC, PASSIVE RESTRAINT SYSTEM HS-016 617  
 OCCUPANT PROTECTION IN REAR IMPACT HS-016 618  
 STRUCTURAL AND OCCUPANT PROTECTION  
 SYSTEMS OF THE OPEL SAFETY VEHICLE HS-016 608  
**OCCUPANTS**  
 SOME METHODS OF ABSORBING THE ENERGY OF  
 MOTOR VEHICLES AND THEIR OCCUPANTS HS-016 611  
 SOME PATTERNS AND CAUSES OF INJURY IN CAR  
 OCCUPANTS HS-016 584  
**OCH**  
 FAKTORER SOM MEDVERKAR TILL LAG FRIKTION  
 MELLAN BILDACK OCH VAGBANA (FACTORS CON-  
 TRIBUTING TO LOW FRICTION BETWEEN WHEELS  
 AND ROAD SURFACE) HS-016 703  
**OECD**  
 YOUNG DRIVER ACCIDENTS. A REPORT PREPARED  
 BY AN OECD ROAD RESEARCH GROUP HS-016 663  
**OPAT**  
 HUMAN INJURY TOLERANCE LEVEL DETERMINA-  
 TION FROM ACCIDENT DATA USING THE OPAT  
 DUMMY HS-016 590  
 PERFORMANCE MEASUREMENTS ON THE OPAT  
 DUMMY HS-016 594  
 THE DEVELOPMENT OF THE OPAT DUMMY HS-016 593  
**OPEL**  
 OPEL'S SAFETY DEVELOPMENT PROGRESS REPORT HS-016 564  
 STRUCTURAL AND OCCUPANT PROTECTION  
 SYSTEMS OF THE OPEL SAFETY VEHICLE HS-016 608  
**OPERATION**  
 DESIGN AND OPERATION OF EUROPEAN TRUCKS  
 FOR MAXIMUM FUEL ECONOMY HS-016 691  
 GUIDELINES ON THE OPERATION OF SUBSCRIP-  
 TION BUS SERVICES HS-016 538  
**OPTIMAL**  
 OPTIMALES ABBREMSEN EINES FAHRZEUGES BEI  
 KURVENFAHRT (OPTIMAL VEHICLE BRAKING  
 DURING A TURN) HS-016 503  
 KURVENFAHRT (OPTIMAL VEHICLE BRAKING  
 DURING A TURN) HS-016 503  
**OPTIMIZER**  
 ELECTRONIC OPTIMIZER CONTROL FOR I. C. EN-  
 GINE: MOST MPG FOR ANY MPH HS-016 534  
**OPTIMUM**  
 THE STOP LAMP: SOME OPTIMUM VISIBILITY CON-  
 siderations HS-016 631  
**ORDINANCES**  
 AGENDA FOR NATIONAL COMMITTEE MEETING  
 (ON UNIFORM TRAFFIC LAWS AND ORDINANCES) HS-016 695  
**OSHA**  
 THE ROPS SAGA: OSHA SAYS ROLL-OVERS MUST  
 BE SAFE HS-016 717  
**OWNER**  
 PAST AND CONTEMPORARY TRENDS OF COMMER-  
 CIAL VEHICLES IN JAPAN AS VIEWED BY FLEET  
 OWNER HS-016 551  
**PANEL**  
 ELECTRONIC DISPLAY APPLICATIONS IN INSTRU-  
 MENT PANEL DESIGN HS-016 530  
 STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
 ECONOMY IMPROVEMENT. SAFETY IMPLICATIONS  
 PANEL REPORT NO. 2 HS-016 500  
 STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
 ECONOMY IMPROVEMENT. TRUCK AND BUS  
 PANEL REPORT NO. 7 HS-016 501  
**PARAMETRIC**  
 FRONT ENERGY MANAGEMENT PARAMETRIC  
 VARIATION STUDY HS-016 600  
**PARAPROFESSIONAL**  
 DRIVER EDUCATION IN CLEVELAND PUBLIC AND  
 NON-PUBLIC SCHOOLS AND APPENDICES  
 (REFERENCES). UTILIZING PARAPROFESSIONAL  
 PERSONNEL AS ROADWORK INSTRUCTORS HS-016 509  
**PARTS**  
 BAYFLEX: A NEW MATERIAL FOR ELASTOMERIC  
 BUMPERS AND BODY PARTS HS-016 546  
**PASSENGER**  
 PASSENGER CAR AND LIGHT TRUCK SHOCK AB-  
 SORBER INSPECTION EQUIPMENT VOL. 1 - SUMMA-  
 RY REPORT. FINAL REPORT HS-801 527

SELECTED CRASH TEST TRUCK ABSORBER INSPECTION EQUIPMENT. VOL. 2 -- TECHNICAL REPORT. FINAL REPORT

HS-801 530

## **PASSIVE**

A REVIEW OF DEVELOPMENT OF PASSIVE RESTRAINT SYSTEMS

HS-016 596

AN OBJECTIVE ANALYSIS OF THE PROTECTION OFFERED BY ACTIVE AND PASSIVE RESTRAINT SYSTEMS

HS-016 693

DEVELOPMENT OF AN ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT CAR DRIVERS. FINAL REPORT

HS-801 528

OCCUPANT PROTECTION IN FRONTAL IMPACT (PASSIVE RESTRAINT), REAR IMPACT AND ROLLOVER

HS-016 568

OCCUPANT PROTECTION IN FRONTAL IMPACTS: A STATIC, PASSIVE RESTRAINT SYSTEM

HS-016 617

## **PATH**

A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF AUTOMOBILE PATH DEVIATIONS WHEN DRIVER STEERS WITH NO VISUAL INPUT

HS-016 653

## **PATTERN**

HYDROPLANING AND TREAD PATTERN HYDRODYNAMICS

HS-016 646

## **PATTERNS**

SOME PATTERNS AND CAUSES OF INJURY IN CAR OCCUPANTS

HS-016 584

## **PEDESTRIAN**

PEDESTRIAN PROTECTION

HS-016 591

THE HAMPSHIRE CHILD PEDESTRIAN ACCIDENT STUDY

HS-016 674

TOWARDS PEDESTRIAN SAFETY

HS-016 595

VEHICLE COMPATIBILITY IN CAR-TO-CAR SIDE IMPACTS AND PEDESTRIAN-TO-CAR FRONTAL IMPACTS

HS-016 612

VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 2 -- ANALYSIS OF ACCIDENT INFORMATION. FINAL REPORT

HS-801 542

VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON A MOCK VEHICLE EXTERIOR. FINAL REPORT

HS-801 544

VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF A CRASH VICTIM -- EXTENSION AND VALIDATION STUDY. FINAL REPORT

HS-801 547

## **PEOPLE**

FOR MORE SAFETY ON OUR ROADS. THE ROAD SAFETY PROGRAMME (PROGRAM) OF THE FEDERAL REPUBLIC OF GERMANY. "PEOPLE HAVE THE RIGHT OF WAY"

HS-016 539

## **PERFORMANCE**

DETERMINATION OF MOTOR VEHICLE CHARACTERISTICS AFFECTING DRIVER HANDLING PERFORMANCE

HS-016 624

DEVELOPMENT OF IMPROVED INFLATION TECHNIQUES. TASK 3 -- SYSTEM PERFORMANCE EVALUATION. 15TH PROGRESS REPORT. 1 JANUARY TO 31 JANUARY 1975

HS-801 590

DEVELOPMENT OF IMPROVED INFLATION TECHNIQUES. TASK 3 -- SYSTEM PERFORMANCE EVALUATION. 16TH PROGRESS REPORT. 1 FEBRUARY TO 31 MARCH 1975

HS-801 591

DRIVER PERFORMANCE. TRANSPORTATION RESEARCH RECORD 520

HS-016 650

DRIVER-VEHICLE CONTROL AND PERFORMANCE IN THE PRESENCE OF AERODYNAMIC DISTURBANCES FROM LARGE VEHICLES

HS-016 651

FACTORS INFLUENCING THE PERFORMANCE OF THE ENERGY ABSORBING STEERING COLUMN IN ACCIDENTS

HS-016 578

FIELD PERFORMANCE OF EMISSIONS-CONTROLLED AUTOMOBILES. CONSULTANT REPORT TO THE COMMITTEE ON MOTOR VEHICLE EMISSIONS. COMMISSION ON SOCIOTECHNICAL SYSTEMS, NATIONAL RESEARCH COUNCIL

HS-016 514

PERFORMANCE MEASUREMENTS ON THE OPAT DUMMY

HS-016 594

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 1-- PROGRAM DEVELOPMENT

HS-016 587

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2-- CRASH TESTING THE GENERAL MOTORS AIR CUSHION

HS-016 588

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 3-- HUMAN VOLUNTEER TESTING

HS-016 589

SAFE PERFORMANCE CURRICULUM FOR SECONDARY SCHOOL DRIVER EDUCATION: PROGRAM DEVELOPMENT, IMPLEMENTATION, AND TECHNICAL FINDINGS. FINAL REPORT

HS-801 491

THE ROLL OF CONNECTING NOZZLE AND THE FLAME INITIATION POINT IN THE PERFORMANCE OF A DUAL CHAMBER STRATIFIED CHARGE ENGINE

HS-016 689

**PERIODICAL**

THE ROAD SAFETY CHECKLIST--A PERIODICAL  
INQUIRY REGARDING TRAFFIC

HS-016 581

**PERSON**

PERSONALITY AND OTHER PERSON-CENTRED  
CHARACTERISTICS

HS-016 668

**PERSONALITY**

PERSONALITY AND OTHER PERSON-CENTRED  
CHARACTERISTICS

HS-016 668

PERSONALITY AND TEMPERAMENT DIFFERENCES  
BETWEEN ALCOHOLICS WITH HIGH AND LOW  
RECORDS OF TRAFFIC ACCIDENTS AND VIOLA-  
TIONS

HS-016 696

**PERSONNEL**

DRIVER EDUCATION IN CLEVELAND PUBLIC AND  
NON-PUBLIC SCHOOLS AND APPENDICES  
(REFERENCES). UTILIZING PARAPROFESSIONAL  
PERSONNEL AS ROADWORK INSTRUCTORS

HS-016 509

**PHILOSOPHY**

PHILOSOPHY, CRITERIA, AND METHODS OF  
DRIVER LICENSING

HS-016 656

**PHYSICS**

THE PHYSICS OF TIRE TRACTION. THEORY AND  
EXPERIMENT

HS-016 516

**PICKUP**

DESIGN AND TEST OF PICKUP TRUCK BOX COVER  
(REFERENCES)

HS-016 545

THE ECONOMICAL DESIGN OF THE DATSUN  
PICKUP

HS-016 553

**PNEUMATIC**

A MODEL ANALYSIS OF THE STRUCTURAL AND  
PNEUMATIC CONTRIBUTIONS TO TIRE BEHAVIOR  
UNDER VERTICAL LOADS

HS-016 677

THE PUNCTURED PNEUMATIC CAR TIRE FROM THE  
USER'S VIEWPOINT

HS-016 635

**POSITIVE**

POSITIVE GUIDANCE IN TRAFFIC CONTROL

HS-016 698

**POSSIBLY**

A COMPUTER-BASED SYSTEM FOR LICENSING EL-  
DERLY DRIVERS AND POSSIBLY OTHERS

HS-016 660

**POST**

STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISION. VOL. 1. FINAL REPORT

HS-801 519

STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISIONS. VOL. 2. FINAL REPORT

HS-801 520

**POTENTIAL**

EMERGENCY SERVICES. WHAT POTENTIAL FOR  
HELICOPTERS IN EMS?

HS-016 701

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. SAFETY IMPLICATIONS  
PANEL REPORT NO. 2

HS-016 500

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. TRUCK AND BUS  
PANEL REPORT NO. 7

HS-016 501

**POWERPLANTS**

AN OVERVIEW OF THE U.S. GOVERNMENT PRO-  
GRAM TO EVALUATE ALTERNATIVE POWER-  
PLANTS TO THE CONVENTIONAL INTERNAL COM-  
BUSTION ENGINES FOR AUTOMOBILES

HS-016 639

**PRECHAMBER**

SINGLE-CYLINDER STUDY OF STRATIFIED CHARGE  
PROCESS WITH PRECHAMBER-INJECTION

HS-016 685

**PREDICT**

DEVELOPMENT OF A COMPUTER SIMULATION TO  
PREDICT THE VISIBILITY DISTANCE PROVIDED BY  
HEADLAMP BEAMS

HS-016 647

**PREPARED**

YOUNG DRIVER ACCIDENTS. A REPORT PREPARED  
BY AN OECD ROAD RESEARCH GROUP

HS-016 663

**PRESENCE**

DRIVER-VEHICLE CONTROL AND PERFORMANCE  
IN THE PRESENCE OF AERODYNAMIC  
DISTURBANCES FROM LARGE VEHICLES

HS-016 651

**PRESENTATION**

FIAT TECHNICAL PRESENTATION

HS-016 570

**PREVENTION**

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 2 -- ANALYSIS OF ACCIDENT IN-  
FORMATION. FINAL REPORT

HS-801 542

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON  
A MOCK VEHICLE EXTERIOR. FINAL REPORT

HS-801 544

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF  
A CRASH VICTIM -- EXTENSION AND VALIDATION  
STUDY. FINAL REPORT

HS-801 547

**PRIORITY**

PRIORITY RULES AT UNCONTROLLED INTERSEC-  
TIONS

HS-016 649

## **PROCEDURE**

DEVELOPMENT OF A SCHOOL BUS FUEL SYSTEM  
INTEGRITY COMPLIANCE PROCEDURE. FINAL RE-  
PORT

HS-801 529

## **PROD**

PROD: CARING FOR DRIVERS

HS-016 507

## **PROPAGATION**

FLAME PROPAGATION IN AN EDDY COMBUSTION  
CHAMBER

HS-016 690

NONLINEAR WAVE PROPAGATION IN  
VISCOELASTIC TUBES: APPLICATION TO AORTIC  
RUPTURE

HS-016 676

## **PROTECTION**

A PRACTICAL APPROACH TO THE PROTECTION OF  
MOTOR VEHICLES BY THE ABSORPTION  
[ABSORPTION] OF IMPACT ENERGY

HS-016 620

AN OBJECTIVE ANALYSIS OF THE PROTECTION OF-  
FERRED BY ACTIVE AND PASSIVE RESTRAINT  
SYSTEMS

HS-016 693

OCCUPANT PROTECTION DURING VEHICLE ROL-  
LOVER

HS-016 619

OCCUPANT PROTECTION IN FRONTAL IMPACT  
(PASSIVE RESTRAINT), REAR IMPACT AND ROL-  
LOVER

HS-016 568

OCCUPANT PROTECTION IN FRONTAL IMPACTS: A  
STATIC, PASSIVE RESTRAINT SYSTEM

HS-016 617

OCCUPANT PROTECTION IN REAR IMPACT

HS-016 618

PEDESTRIAN PROTECTION

HS-016 591

STRUCTURAL AND OCCUPANT PROTECTION  
SYSTEMS OF THE OPEL SAFETY VEHICLE

HS-016 608

## **PUBLIC**

AN ANALYSIS OF FARM EQUIPMENT ACCIDENTS  
ON NORTH CAROLINA PUBLIC ROADS

HS-016 499

DRIVER EDUCATION IN CLEVELAND PUBLIC AND  
NON-PUBLIC SCHOOLS AND APPENDICES  
(REFERENCES). UTILIZING PARAPROFESSIONAL  
PERSONNEL AS ROADWORK INSTRUCTORS

HS-016 509

RSV, CRASH HAZARDS AND PUBLIC SUPPORT

HS-016 599

## **PUNCTURED**

THE PUNCTURED PNEUMATIC CAR TIRE FROM THE  
USER'S VIEWPOINT

HS-016 635

## **PYROTECHNIC**

SPECIFICATION AND SIMULATION OF  
PYROTECHNIC ENVIRONMENTS

HS-016 541

## **RALEIGH**

HIGHWAY SAFETY PROGRAMS: HOW DO WE KNOW  
THEY WORK? NORTH CAROLINA SYMPOSIUM ON  
HIGHWAY SAFETY, RALEIGH, SPRING, 1974. VOL. 10

HS-016 648

## **RATIO**

IS THERE A SELECTION RATIO IN THE FUTURE OF  
LICENSING?

HS-016 662

## **RE**

YOU'RE A WHAT? [DRIVER EDUCATION]

HS-016 714

## **REACTORS**

VOLUME AND TEMPERATURE INFLUENCES ON  
THE EFFECTIVENESS OF LEAN THERMAL REAC-  
TORS

HS-016 687

## **REAR**

OCCUPANT PROTECTION IN FRONTAL IMPACT  
(PASSIVE RESTRAINT), REAR IMPACT AND ROL-  
LOVER

HS-016 568

OCCUPANT PROTECTION IN REAR IMPACT

HS-016 618

## **RECHEN**

VERGLEICH EINIGER RECHEN- UND MESSERGEB-  
NISSE ZUM FAHRVERHALTEN VON SATTELZUGEN  
(COMPARISON OF SOME THEORETICAL AND EX-  
PERIMENTAL RESULTS ON THE DIRECTIONAL  
DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)

HS-016 504

## **RECOMMENDATIONS**

BASIC TRAINING PROGRAM FOR DRIVER LICENSE  
EXAMINERS: CONCEPTS AND RECOMMENDATIONS  
-- FINAL REPORT

HS-801 517

## **RECOMMENDED**

RECOMMENDED U.S. AUTOMOTIVE EMISSION  
STANDARDS

HS-016 711

## **RECREATION**

THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE  
AS A MODE OF TRANSPORTATION AND RECREA-  
TION. ATLANTA METROPOLITAN REGION

HS-016 517

THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE  
AS A MODE OF TRANSPORTATION AND RECREA-  
TION. ATLANTA METROPOLITAN REGION. TECHNICAL  
APPENDIX

HS-016 518

## **RECREATIONAL**

RECREATIONAL VEHICLE ACCIDENT INVESTIGA-  
TION STUDY. INTERIM REPORT

HS-801 523

**REGULATION**

THE EFFECTS OF AUTOMOBILE SAFETY REGULATION

HS-016 511

**REGULATIONS**

APPLICATION TO REGULATIONS OF STUDIES MADE PURSUANT TO THE ESV PROGRAM

HS-016 645

**RELATIONSHIP**

RELATIONSHIP BETWEEN VEHICLE FRONT-END DEFORMATION AND EFFICIENCY OF SAFETY BELTS DURING FRONTAL IMPACT

HS-016 606

**RELATIONSHIPS**

EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE, CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR CRASHES

HS-016 577

**RENAULT**

BASIC RESEARCH VEHICLE--RENAULT BRV

HS-016 562

**RESISTANCE**

EFFECTS OF TIRE ROLLING RESISTANCE ON VEHICLE FUEL CONSUMPTION

HS-016 675

**RESPONSE**

DRIVER/VEHICLE RESPONSE RESEARCH

HS-016 625

**RESTRAINT**

A REVIEW OF DEVELOPMENT OF PASSIVE RESTRAINT SYSTEMS

HS-016 596

A SAMPLING PROGRAM FOR EVALUATION OF THE 1974 RESTRAINT SYSTEMS

HS-016 699

AN OBJECTIVE ANALYSIS OF THE PROTECTION OFFERED BY ACTIVE AND PASSIVE RESTRAINT SYSTEMS

HS-016 693

CHARACTERISTICS OF BODY ENERGY ABSORPTION AND RESTRAINT SYSTEM

HS-016 623

DEVELOPMENT OF AN ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT CAR DRIVERS. FINAL REPORT

HS-801 528

NHTSA'S EVALUATION OF AIR CUSHION RESTRAINT SYSTEM EFFECTIVENESS (ACRS)

HS-016 579

OCCUPANT PROTECTION IN FRONTAL IMPACT (PASSIVE RESTRAINT), REAR IMPACT AND ROLL-OVER

HS-016 568

OCCUPANT PROTECTION IN FRONTAL IMPACTS: A STATIC, PASSIVE RESTRAINT SYSTEM

HS-016 617

**RETARDER**

BRAKESAVER - CATERPILLAR'S HIGHWAY TRUCK

**REVIEWS**

REVIEWS ON ACCURACIES AND RESULTS OF ESV COLLISION TESTS

HS-016 622

**RIDES**

DEATH OFTEN RIDES AT THE WHEEL OF THE DROWSY DRIVER

HS-016 673

**RIGHT**

FOR MORE SAFETY ON OUR ROADS. THE ROAD SAFETY PROGRAMME (PROGRAM) OF THE FEDERAL REPUBLIC OF GERMANY. "PEOPLE HAVE THE RIGHT OF WAY"

HS-016 539

**RISK**

ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT

HS-801 435

ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT

HS-801 436

ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES; PHASE 1: HIGH RISK DRIVER STUDY PLAN. REPORT

HS-801 433

ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT ON PHASE 1

HS-801 434

**ROAD**

A TECHNIQUE FOR THE VALIDATION OF VEHICLE MODELS USING THE ROAD SIMULATOR

HS-016 543

COMPATIBILITY ON THE ROAD

HS-016 604

FAKTORER SOM MEDVERKAR TILL LAG FRIKTION MELLAN BILDACK OCH VAGBANA (FACTORS CONTRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)

HS-016 703

FOR MORE SAFETY ON OUR ROADS. THE ROAD SAFETY PROGRAMME (PROGRAM) OF THE FEDERAL REPUBLIC OF GERMANY. "PEOPLE HAVE THE RIGHT OF WAY"

HS-016 539

ONE TOO MANY FOR THE ROAD [DRINKING DRIVERS]

HS-016 512

THE ROAD SAFETY CHECKLIST--A PERIODICAL INQUIRY REGARDING TRAFFIC

HS-016 581

YOUNG DRIVER ACCIDENTS. A REPORT PREPARED BY AN OECD ROAD RESEARCH GROUP

HS-016 663

**ROADS**

AN ANALYSIS OF FARM EQUIPMENT ACCIDENTS ON NORTH CAROLINA PUBLIC ROADS

HS-016 499

FOR MORE SAFETY ON OUR ROADS. THE ROAD SAFETY PROGRAMME (PROGRAM) OF THE

THE RIGHT OF WAY"	HS-016 539	A VEHICLE WHEN FAIL-SAFE TIRE IS DEFLATED	HS-016 637
<b>ROADWORK</b>		THE ROPS SAGA: OSHA SAYS ROLL-OVERS MUST BE SAFE	HS-016 717
DRIVER EDUCATION IN CLEVELAND PUBLIC AND NON-PUBLIC SCHOOLS AND APPENDICES (REFERENCES). UTILIZING PARAPROFESSIONAL PERSONNEL AS ROADWORK INSTRUCTORS	HS-016 509	<b>SAGA</b>	
		THE ROPS SAGA: OSHA SAYS ROLL-OVERS MUST BE SAFE	HS-016 717
<b>ROLL</b>		<b>SAMPLING</b>	
THE ROLL OF CONNECTING NOZZLE AND THE FLAME INITIATION POINT IN THE PERFORMANCE OF A DUAL CHAMBER STRATIFIED CHARGE ENGINE	HS-016 689	A SAMPLING PROGRAM FOR EVALUATION OF THE 1974 RESTRAINT SYSTEMS	HS-016 699
THE ROPS SAGA: OSHA SAYS ROLL-OVERS MUST BE SAFE	HS-016 717	<b>SATTELZUGEN</b>	
<b>ROLLED</b>		VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTER VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON THE DIRECTIONAL DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)	HS-016 504
PRESENT STATUS OF COLD-ROLLED HIGH STRENGTH STEEL DEVELOPMENT	HS-016 544	<b>SCHOOL</b>	
<b>ROLLING</b>		DEVELOPMENT OF A SCHOOL BUS FUEL SYSTEM INTEGRITY COMPLIANCE PROCEDURE. FINAL REPORT	HS-801 529
EFFECTS OF TIRE ROLLING RESISTANCE ON VEHICLE FUEL CONSUMPTION	HS-016 675	SAFE PERFORMANCE CURRICULUM FOR SECONDARY SCHOOL DRIVER EDUCATION: PROGRAM DEVELOPMENT, IMPLEMENTATION, AND TECHNICAL FINDINGS. FINAL REPORT	HS-801 491
<b>ROLLOVER</b>		<b>SCHOOLS</b>	
OCCUPANT PROTECTION DURING VEHICLE ROLLOVER	HS-016 619	DRIVER EDUCATION IN CLEVELAND PUBLIC AND NON-PUBLIC SCHOOLS AND APPENDICES (REFERENCES). UTILIZING PARAPROFESSIONAL PERSONNEL AS ROADWORK INSTRUCTORS	HS-016 509
OCCUPANT PROTECTION IN FRONTAL IMPACT (PASSIVE RESTRAINT), REAR IMPACT AND ROLLOVER	HS-016 568	<b>SEAT</b>	
THE MECHANICS OF ROLLOVER AS THE RESULT OF CURB IMPACT	HS-016 537	A RESEARCH STUDY FOR AN ENERGY ABSORBING SLIDING SEAT	HS-016 610
<b>ROPS</b>		EVALUATION OF SEAT BELT SYSTEM AND DUMMY CHARACTERISTICS	HS-016 598
THE ROPS SAGA: OSHA SAYS ROLL-OVERS MUST BE SAFE	HS-016 717	<b>SECONDARY</b>	
<b>RSV</b>		SAFE PERFORMANCE CURRICULUM FOR SECONDARY SCHOOL DRIVER EDUCATION: PROGRAM DEVELOPMENT, IMPLEMENTATION, AND TECHNICAL FINDINGS. FINAL REPORT	HS-801 491
RSV, CRASH HAZARDS AND PUBLIC SUPPORT	HS-016 599	<b>SEMITRAILER</b>	
<b>RULES</b>		VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTER VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON THE DIRECTIONAL DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)	HS-016 504
PRIORITY RULES AT UNCONTROLLED INTERSECTIONS	HS-016 649		
<b>RUPTURE</b>			
NONLINEAR WAVE PROPAGATION IN VISCOELASTIC TUBES: APPLICATION TO AORTIC RUPTURE	HS-016 676		
<b>SAFE</b>			
SAFE PERFORMANCE CURRICULUM FOR SECONDARY SCHOOL DRIVER EDUCATION: PROGRAM DEVELOPMENT, IMPLEMENTATION, AND TECHNICAL FINDINGS. FINAL REPORT	HS-801 491		

**SENSING**

DESIGN SOLUTIONS FOR TEMPERATURE SENSING  
IN DIFFICULT AUTOMOTIVE APPLICATIONS

HS-016 550

**SEVERITY**

EVALUATION OF TIRE ABRASION IN TERMS OF  
DRIVING SEVERITY

HS-016 706

**SHEAR**

ENERGY ABSORPTION BY VARIABLE SHEAR  
STRENGTH DUPLEX MATERIALS

HS-016 616

**SHOCK**

PASSENGER CAR AND LIGHT TRUCK SHOCK AB-  
SORBER INSPECTION EQUIPMENT VOL. 1 -- SUMMA-  
RY REPORT. FINAL REPORT

HS-801 527

PASSENGER CAR AND LIGHT TRUCK SHOCK AB-  
SORBER INSPECTION EQUIPMENT. VOL. 2 --  
TECHNICAL REPORT. FINAL REPORT

HS-801 530

**SICK**

EMERGENCY CARE AND TRANSPORTATION OF THE  
SICK AND INJURED

HS-016 713

**SIDE**

BIOMECHANICAL STUDY OF SIDE IMPACT AC-  
CIDENTS

HS-016 592

VEHICLE COMPATIBILITY IN CAR-TO-CAR SIDE IM-  
PACTS AND PEDESTRIAN-TO-CAR FRONTAL IM-  
PACTS

HS-016 612

**SILENCING**

ENGINE SILENCING--CHANGES IN EMPHASIS

HS-016 513

**SIMULATION**

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 1.  
ENGINEERING MANUAL. FINAL REPORT

HS-801 507

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2.  
MODEL VALIDATION. FINAL REPORT

HS-801 508

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 3.  
USER MANUAL. FINAL REPORT

HS-801 509

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 4.  
PROGRAMMERS MANUAL. FINAL REPORT

HS-801 510

DEVELOPMENT OF A COMPUTER SIMULATION TO  
PREDICT THE VISIBILITY DISTANCE PROVIDED BY  
HEADLAMP BEAMS

HS-016 647

SPECIFICATION AND SIMULATION OF  
PYROTECHNIC ENVIRONMENTS

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF  
A CRASH VICTIM -- EXTENSION AND VALIDATION  
STUDY. FINAL REPORT

HS-801 547

**SIMULATIONS**

THE APPLICATION OF COMPUTER SIMULATIONS IN  
VEHICLE SAFETY

HS-016 613

**SIMULATOR**

A TECHNIQUE FOR THE VALIDATION OF VEHICLE  
MODELS USING THE ROAD SIMULATOR

HS-016 543

**SINGLE**

SINGLE-CYLINDER STUDY OF STRATIFIED CHARGE  
PROCESS WITH PRECHAMBER-INJECTION

HS-016 685

**SIZE**

EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE,  
CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR  
CRASHES

HS-016 577

**SLIDING**

A RESEARCH STUDY FOR AN ENERGY ABSORBING  
SLIDING SEAT

HS-016 610

**SLIP**

MEASUREMENT OF TRANSIENT SLIP ANGLES OF  
TIRES--A CONTRIBUTION OF EVALUATING SAFETY-  
RELEVANT DRIVING CONDITIONS

HS-016 627

**SOCIAL**

CRITICAL ASSESSMENT OF SOCIAL AND  
ECONOMIC IMPLICATIONS OF SAFETY CARs

HS-016 556

**SOCIOTECHNICAL**

FIELD PERFORMANCE OF EMISSIONS-CON-  
TROLLED AUTOMOBILES. CONSULTANT REPORT  
TO THE COMMITTEE ON MOTOR VEHICLE EMIS-  
SIONS. COMMISSION ON SOCIOTECHNICAL  
SYSTEMS, NATIONAL RESEARCH COUNCIL

HS-016 514

**SOLID**

THE INFLUENCE OF WIND TUNNEL SOLID BOUN-  
DARIES ON AUTOMOTIVE TEST DATA

HS-016 547

**SOLUTIONS**

DESIGN SOLUTIONS FOR TEMPERATURE SENSING  
IN DIFFICULT AUTOMOTIVE APPLICATIONS

HS-016 550

**SOM**

FAKTORER SOM MEDVERKAR TILL LAG FRIKTION  
MELLAN BILDACK OCH VAGBANA (FACTORS CON-  
TRIBUTING TO LOW FRICTION BETWEEN WHEELS  
AND ROAD SURFACE)

HS-016 703



October 31, 1975

## **SPECIFICATION**

SPECIFICATION AND SIMULATION OF  
PYROTECHNIC ENVIRONMENTS

HS-016 541

## **SPEED**

SOME CONSIDERATIONS OF BODY STRUCTURE  
CRUSHABILITY IN RELATION TO IMPACT SPEED

HS-016 609

## **SPEEDING**

DEADLY DRIVING HABITS. 104 YEAR OLD  
RESOLVES TO QUIT SPEEDING

HS-016 505

## **SPIN**

AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF  
WHEEL SPIN-DOWN AND OTHER VARIABLES.  
FINAL REPORT

HS-016 700

## **SPRING**

HIGHWAY SAFETY PROGRAMS: HOW DO WE KNOW  
THEY WORK? NORTH CAROLINA SYMPOSIUM ON  
HIGHWAY SAFETY, RALEIGH, SPRING, 1974. VOL. 10

HS-016 648

## **STABILITY**

IMPROVING DIRECTIONAL STABILITY UNDER  
BRAKING

HS-016 629

## **STANDARDIZATION**

A CASE FOR STANDARDIZATION [TRUCK WIRING]

HS-016 684

## **STANDARDS**

ENVIRONMENTALLY ASSISTED FRACTURING:  
RESEARCH AND STANDARDS

HS-016 721

PROGRESS IN THE IMPLEMENTATION OF MOTOR  
VEHICLE EMISSION STANDARDS THROUGH JUNE  
1974. REPORT TO CONGRESS

HS-016 702

RECOMMENDED U.S. AUTOMOTIVE EMISSION  
STANDARDS

HS-016 711

## **STATES**

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 1. UNITED  
STATES

HS-016 558

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 1. UNITED  
STATES [ESV TESTING]

HS-016 559

## **STATIC**

OCCUPANT PROTECTION IN FRONTAL IMPACTS: A  
STATIC, PASSIVE RESTRAINT SYSTEM

HS-016 617

## **STATISTICAL**

SYNTHESIS OF STATISTICAL DATA ON TRAFFIC  
ACCIDENTS IN FRANCE, WEST GERMANY, ITALY  
AND UNITED KINGDOM

HS-016 580

## **STATISTICS**

MICHIGAN DRIVER STATISTICS. REPORT NO. 7.  
JUNE 25, 1974

HS-016 716

## **STEEL**

PRESENT STATUS OF COLD-ROLLED HIGH  
STRENGTH STEEL DEVELOPMENT

HS-016 544

## **STEERABILITY**

STEERABILITY DURING EMERGENCY BRAKING.  
SWEDISH ESV PROJECT

HS-016 571

## **STEERING**

A LABORATORY FATIGUE TEST PROGRAM FOR  
STEERING COMPONENTS BASED ON FIELD LOAD  
DATA

HS-016 542

FACTORS INFLUENCING THE PERFORMANCE OF  
THE ENERGY ABSORBING STEERING COLUMN IN  
ACCIDENTS

HS-016 578

STEERING AND HANDLING CHARACTERISTICS OF  
A VEHICLE WHEN FAIL-SAFE TIRE IS DEFLATED

HS-016 637

## **STEERS**

A THEORETICAL AND EXPERIMENTAL INVESTIGA-  
TION OF AUTOMOBILE PATH DEVIATIONS WHEN  
DRIVER STEERS WITH NO VISUAL INPUT

HS-016 653

## **STOP**

THE STOP LAMP: SOME OPTIMUM VISIBILITY CON-  
SIDERATIONS

HS-016 631

## **STRATIFIED**

SINGLE-CYLINDER STUDY OF STRATIFIED CHARGE  
PROCESS WITH PRECHAMBER-INJECTION

HS-016 685

THE ROLL OF CONNECTING NOZZLE AND THE  
FLAME INITIATION POINT IN THE PERFORMANCE  
OF A DUAL CHAMBER STRATIFIED CHARGE EN-  
GINE

HS-016 689

## **STRENGTH**

ENERGY ABSORPTION BY VARIABLE SHEAR  
STRENGTH DUPLEX MATERIALS

HS-016 616

PRESENT STATUS OF COLD-ROLLED HIGH  
STRENGTH STEEL DEVELOPMENT

HS-016 544

## **STRUCTURAL**

A MODEL ANALYSIS OF THE STRUCTURAL AND  
PNEUMATIC CONTRIBUTIONS TO TIRE BEHAVIOR  
UNDER VERTICAL LOADS

HS-016 677

STRUCTURAL AND OCCUPANT PROTECTION  
SYSTEMS OF THE OPEL SAFETY VEHICLE

HS-016 608

## STRUCTURE

SOME CONSIDERATIONS OF BODY STRUCTURE CRUSHABILITY IN RELATION TO IMPACT SPEED

HS-016 609

## STUDED

THE CASE FOR SAFETY WITH STUDED TIRES

HS-016 704

THE CASE FOR SAFETY WITH STUDED TIRES. PT. 2. SUPPORT DATA

HS-016 705

## SUBCOMPACT

DEVELOPMENT OF AN ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT CAR DRIVERS. FINAL REPORT

HS-801 528

## SUBSCRIPTION

GUIDELINES ON THE OPERATION OF SUBSCRIPTION BUS SERVICES

HS-016 538

## SUICIDAL

SUICIDAL CRASHER. WATCH OUT FOR THE WRONG WAY DRIVER...DEATH MAY BE HIS OBJECTIVE

HS-016 718

## SUPPLIER

AUTO ELECTRONICS: A SEMICONDUCTOR SUPPLIER'S VIEWPOINT

HS-016 523

## SUPPORT

RSV, CRASH HAZARDS AND PUBLIC SUPPORT

HS-016 599

THE CASE FOR SAFETY WITH STUDED TIRES. PT. 2. SUPPORT DATA

HS-016 705

## SURFACE

CONTACT OF AN INFLATED TOROIDAL MEMBRANE WITH A FLAT SURFACE AS AN APPROACH TO THE TIRE DEFLECTION PROBLEM

HS-016 678

FAKTORER SOM MEDVERKAR TILL LAG FRIKTION MELLAN BILDACK OCH VAGBANA (FACTORS CONTRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)

HS-016 703

## SWEDISH

STEERABILITY DURING EMERGENCY BRAKING. SWEDISH ESV PROJECT

HS-016 571

## SYNTHESIS

SYNTHESIS OF STATISTICAL DATA ON TRAFFIC ACCIDENTS IN FRANCE, WEST GERMANY, ITALY AND UNITED KINGDOM

HS-016 580

## TEMPERAMENT

PERSONALITY AND TEMPERAMENT DIFFERENCES BETWEEN ALCOHOLICS WITH HIGH AND LOW RECORDS OF TRAFFIC ACCIDENTS AND VIOLATIONS

HS-016 696

## TEMPERATURE

A NEW INTERFACING CONCEPT: THE MONOLITHIC TEMPERATURE TRANSDUCER

HS-016 549

DESIGN SOLUTIONS FOR TEMPERATURE SENSING IN DIFFICULT AUTOMOTIVE APPLICATIONS

HS-016 550

VOLUME AND TEMPERATURE INFLUENCES ON THE EFFECTIVENESS OF LEAN THERMAL REACTORS

HS-016 687

## TESTING

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS. PT. 1. UNITED STATES [ESV TESTING]

HS-016 559

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2.- CRASH TESTING THE GENERAL MOTORS AIR CUSHION

HS-016 588

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 3.- HUMAN VOLUNTEER TESTING

HS-016 589

## TEXAS

AN AID ANALYSIS OF TEXAS TRAFFIC ACCIDENT DATA BEFORE AND DURING THE ENERGY CRISIS.

HS-016 682

## THEORETICAL

A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF AUTOMOBILE PATH DEVIATIONS WHEN DRIVER STEERS WITH NO VISUAL INPUT

HS-016 653

THEORETICAL STUDY OF NONLINEAR MEMBRANE PROBLEMS WITH APPLICATIONS TO AIR BAGS. FINAL REPORT

HS-801 540

VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTEN VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON THE DIRECTIONAL DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)

HS-016 504

## THERE

IS THERE A SELECTION RATIO IN THE FUTURE OF LICENSING?

HS-016 662

## THERMAL

VOLUME AND TEMPERATURE INFLUENCES ON THE EFFECTIVENESS OF LEAN THERMAL REACTORS

HS-016 687

## THORACIC

THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES) VOL. 1 EXECUTIVE SUMMARY. FINAL REPORT

HS-801 557

(EXPERIMENTAL TISSUE PROPERTIES). VOL. 2. TECHNICAL REPORT. FINAL REPORT	HS-016 704
THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES). VOLUME 3. LITERATURE SURVEY. FINAL REPORT	HS-016 705
HS-801 558	
HS-801 559	
<b>TILL</b> FAKTORER SOM MEDVERKAR TILL LAG FRIKTION MELLAN BILDACK OCH VAGBANA (FACTORS CON- TRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)	HS-016 703
<b>TIMING</b> MEASUREMENT OF AUTOMOTIVE TIMING CHAIN DRIVE LOADS	HS-016 548
<b>TIRE</b> A MODEL ANALYSIS OF THE STRUCTURAL AND PNEUMATIC CONTRIBUTIONS TO TIRE BEHAVIOR UNDER VERTICAL LOADS	HS-016 677
AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF WHEEL SPIN-DOWN AND OTHER VARIABLES. FINAL REPORT	HS-016 700
CONTACT OF AN INFLATED TOROIDAL MEMBRANE WITH A FLAT SURFACE AS AN APPROACH TO THE TIRE DEFLECTION PROBLEM	HS-016 678
EFFECTS OF TIRE ROLLING RESISTANCE ON VEHI- CLE FUEL CONSUMPTION	HS-016 675
EVALUATION OF TIRE ABRASION IN TERMS OF DRIVING SEVERITY	HS-016 706
LARGE-TRUCK ACCIDENTS INVOLVING TIRE FAILURE	HS-016 515
STEERING AND HANDLING CHARACTERISTICS OF A VEHICLE WHEN FAIL-SAFE TIRE IS DEFLATED	HS-016 637
THE PHYSICS OF TIRE TRACTION. THEORY AND EXPERIMENT	HS-016 516
THE PUNCTURED PNEUMATIC CAR TIRE FROM THE USER'S VIEWPOINT	HS-016 635
<b>TIRES</b> CHARACTERISTICS OF JAPANESE ESV TIRES	HS-016 636
EVERYTHING YOU NEED TO KNOW ABOUT TIRES	HS-016 719
MEASUREMENT OF TRANSIENT SLIP ANGLES OF TIRES--A CONTRIBUTION OF EVALUATING SAFETY- RELEVANT DRIVING CONDITIONS	HS-016 627
SAFETY ASPECTS OF DENOVO RUN FLAT TIRES	HS-016 632
THE CASE FOR SAFETY WITH STUDDUED TIRES. PT. 2. SUPPORT DATA	HS-016 705
<b>TISSUE</b> THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES) VOL. 1 EX- ECUTIVE SUMMARY. FINAL REPORT	HS-801 557
THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES). VOL. 2. TECHNICAL REPORT. FINAL REPORT	HS-801 558
THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES). VOLUME 3. LITERATURE SURVEY. FINAL REPORT	HS-801 559
<b>TOLERANCE</b> HUMAN INJURY TOLERANCE LEVEL DETERMINA- TION FROM ACCIDENT DATA USING THE OPAT DUMMY	HS-016 590
HUMAN TOLERANCE RESEARCH PROGRAM. FIRST YEAR INTERIM REPORT	HS-016 506
RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 1-- PROGRAM DEVELOPMENT	HS-016 587
RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2-- CRASH TESTING THE GENERAL MOTORS AIR CUSHION	HS-016 588
RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 3-- HUMAN VOLUNTEER TESTING	HS-016 589
<b>TORCH</b> COMBUSTION CHARACTERISTICS OF THE TORCH IGNITED ENGINE	HS-016 686
<b>TOROIDAL</b> CONTACT OF AN INFLATED TOROIDAL MEMBRANE WITH A FLAT SURFACE AS AN APPROACH TO THE TIRE DEFLECTION PROBLEM	HS-016 678
<b>TOYOTA</b> THE TEST OF JAPANESE EXPERIMENTAL VEHI- CLES (SUMMARY OF TOYOTA ESV TEST)	HS-016 573
<b>TRACTION</b> THE PHYSICS OF TIRE TRACTION. THEORY AND EXPERIMENT	HS-016 516
<b>TRACTOR</b> VERGLEICH EINIGER RECHEN- UND MESSERGEB- NISSE ZUM FAHRVERHALTER VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EX-	

PERIMENTAL RESULTS ON THE DIRECTIONAL  
DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)  
HS-016 504

## TRAFFIC

AGENDA FOR NATIONAL COMMITTEE MEETING  
(ON UNIFORM TRAFFIC LAWS AND ORDINANCES)  
HS-016 695

AN AID ANALYSIS OF TEXAS TRAFFIC ACCIDENT  
DATA BEFORE AND DURING THE ENERGY CRISIS.  
HS-016 682

PERSONALITY AND TEMPERAMENT DIFFERENCES  
BETWEEN ALCOHOLICS WITH HIGH AND LOW  
RECORDS OF TRAFFIC ACCIDENTS AND VIOLA-  
TIONS  
HS-016 696

POSITIVE GUIDANCE IN TRAFFIC CONTROL  
HS-016 698

SYNTHESIS OF STATISTICAL DATA ON TRAFFIC  
ACCIDENTS IN FRANCE, WEST GERMANY, ITALY  
AND UNITED KINGDOM  
HS-016 580

THE ROAD SAFETY CHECKLIST--A PERIODICAL  
INQUIRY REGARDING TRAFFIC  
HS-016 581

TRAFFIC ACCIDENTS IN JAPAN  
HS-016 575

TRAFFIC CIRCULATION PLANNING FOR COMMUNI-  
TIES  
HS-016 712

TRAFFIC FATALITIES AND THE ENERGY CRISIS: A  
SECOND FOUR MONTH ANALYSIS MAY - AUG 1974  
HS-016 732

## TRAINING

BASIC TRAINING PROGRAM FOR DRIVER LICENSE  
EXAMINERS: CONCEPTS AND RECOMMENDATIONS  
-- FINAL REPORT  
HS-801 517

DRIVER TRAINING  
HS-016 669

## TRANSDUCER

A NEW INTERFACING CONCEPT: THE MONOLITHIC  
TEMPERATURE TRANSDUCER  
HS-016 549

## TRANSIENT

MEASUREMENT OF TRANSIENT SLIP ANGLES OF  
TIRES--A CONTRIBUTION OF EVALUATING SAFETY-  
RELEVANT DRIVING CONDITIONS  
HS-016 627

## TRANSPORTATION

DRIVER PERFORMANCE. TRANSPORTATION  
RESEARCH RECORD 520  
HS-016 650

EMERGENCY CARE AND TRANSPORTATION OF THE  
SICK AND INJURED  
HS-016 713

THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE  
AS A MODE OF TRANSPORTATION AND RECREA-  
TION. ATLANTA METROPOLITAN REGION

THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE  
AS A MODE OF TRANSPORTATION AND RECREA-  
TION. ATLANTA METROPOLITAN REGION. TECHNICAL  
APPENDIX  
HS-016 518

THE EVALUATION OF SAFETY, ENERGY, AND EN-  
VIRONMENTAL FACTORS IN THE AUTOMOTIVE  
TRANSPORTATION SYSTEM  
HS-016 638

## TREAD

HYDROPLANING AND TREAD PATTERN  
HYDRODYNAMICS  
HS-016 646

## TRUCK

A CASE FOR STANDARDIZATION [TRUCK WIRING]  
HS-016 684

BRAKESAVER -- CATERPILLAR'S HIGHWAY TRUCK  
RETARDER  
HS-016 554

CAB CONDITION -- HEATING AND COOLING--  
HEAVY DUTY TRUCK AND OFF-HIGHWAY EQUIP-  
MENT  
HS-016 694

DESIGN AND TEST OF PICKUP TRUCK BOX COVER  
HS-016 545

LARGE-TRUCK ACCIDENTS INVOLVING TIRE  
FAILURE  
HS-016 515

PASSENGER CAR AND LIGHT TRUCK SHOCK AB-  
SORBER INSPECTION EQUIPMENT VOL. 1 -- SUMMA-  
RY REPORT. FINAL REPORT  
HS-801 527

PASSENGER CAR AND LIGHT TRUCK SHOCK AB-  
SORBER INSPECTION EQUIPMENT. VOL. 2 --  
TECHNICAL REPORT. FINAL REPORT  
HS-801 530

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. TRUCK AND BUS  
FANAL REPORT NO. 7  
HS-016 501

## TRUCKS

DESIGN AND OPERATION OF EUROPEAN TRUCKS  
FOR MAXIMUM FUEL ECONOMY  
HS-016 691

## TUBES

NONLINEAR WAVE PROPAGATION IN  
VISCOELASTIC TUBES: APPLICATION TO AORTIC  
RUPTURE  
HS-016 676

## TUNNEL

THE INFLUENCE OF WIND TUNNEL SOLID BOUN-  
DARIES ON AUTOMOTIVE TEST DATA  
HS-016 547

## TURN

FURTHER RESEARCH ON THE DRIVER/VEHICLE  
SYSTEM STUDY OF BRAKING IN A TURN  
HS-016 630

OPTIMALES ABBREMSEN EINES FAHRZEUGES BEI

October 31, 1975

## **TWICE**

THINKING TWICE ABOUT HIGHWAY SAFETY.  
[WISCONSIN] GOVERNOR'S CONFERENCE ON  
HIGHWAY SAFETY IMPROVEMENT

HS-016 680

## **UNCONTROLLED**

PRIORITY RULES AT UNCONTROLLED INTERSEC-  
TIONS

HS-016 649

## **USAGE**

ELECTRONIC EQUIPMENT USAGE ON JAPANESE  
VEHICLES

HS-016 522

## **VAGBANA**

FAKTORER SOM MEDVERKAR TILL LAG FRIKTION  
MELLAN BILDACK OCH VAGBANA (FACTORS CON-  
TRIBUTING TO LOW FRICTION BETWEEN WHEELS  
AND ROAD SURFACE)

HS-016 703

## **VALIDATION**

A TECHNIQUE FOR THE VALIDATION OF VEHICLE  
MODELS USING THE ROAD SIMULATOR

HS-016 543

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2.  
MODEL VALIDATION. FINAL REPORT

HS-801 508

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 5-A 3-D MATH SIMULATION OF  
A CRASH VICTIM - EXTENSION AND VALIDATION  
STUDY. FINAL REPORT

HS-801 547

## **VARIABLE**

ENERGY ABSORPTION BY VARIABLE SHEAR  
STRENGTH DUPLEX MATERIALS

HS-016 616

## **VARIABLES**

AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF  
WHEEL SPIN-DOWN AND OTHER VARIABLES.  
FINAL REPORT

HS-016 700

## **VARIATION**

FRONT ENERGY MANAGEMENT PARAMETRIC  
VARIATION STUDY

HS-016 600

## **VEHICLE**

[CITROEN EXPERIMENTAL SAFETY VEHICLE PRO-  
GRAM]

HS-016 563

[THE SAFETY VEHICLE PROGRAM AT BRITISH LEY-  
LAND MOTOR CORPORATION]

HS-016 567

A TECHNIQUE FOR THE VALIDATION OF VEHICLE  
MODELS USING THE ROAD SIMULATOR

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2.  
MODEL VALIDATION. FINAL REPORT

HS-801 508

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 3.  
USER MANUAL. FINAL REPORT

HS-801 509

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 4.  
PROGRAMMERS MANUAL. FINAL REPORT

HS-801 510

BASIC RESEARCH VEHICLE--RENAULT BRV

HS-016 562

DETERMINATION OF MOTOR VEHICLE CHARAC-  
TERISTICS AFFECTING DRIVER HANDLING PER-  
FORMANCE

HS-016 624

DRIVER-VEHICLE CONTROL AND PERFORMANCE  
IN THE PRESENCE OF AERODYNAMIC  
DISTURBANCES FROM LARGE VEHICLES

HS-016 651

EFFECTS OF TIRE ROLLING RESISTANCE ON VEHI-  
CLE FUEL CONSUMPTION

HS-016 675

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 1. UNITED  
STATES

HS-016 558

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 1. UNITED  
STATES [ESV TESTING]

HS-016 559

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 2. EUROPEAN  
EXPERIMENTAL VEHICLES COMMITTEE

HS-016 560

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 6. ITALY

HS-016 569

FEASIBILITY STUDY OF IN-VEHICLE WARNING  
SYSTEMS. FINAL REPORT

HS-801 569

FIELD PERFORMANCE OF EMISSIONS-CON-  
TROLLED AUTOMOBILES. CONSULTANT REPORT  
TO THE COMMITTEE ON MOTOR VEHICLE EMIS-  
SIONS. COMMISSION ON SOCIOTECHNICAL  
SYSTEMS, NATIONAL RESEARCH COUNCIL

HS-016 514

OCCUPANT PROTECTION DURING VEHICLE ROL-  
LOVER

HS-016 619

OPTIMALES ABBREMSEN EINES FAHRZEUGES BEI  
KURVENFAHRT (OPTIMAL VEHICLE BRAKING  
DURING A TURN)

HS-016 503

PROGRESS IN THE IMPLEMENTATION OF MOTOR

RELATIONSHIP BETWEEN VEHICLE FRONT-END DEFORMATION AND EFFICIENCY OF SAFETY BELTS DURING FRONTAL IMPACT

HS-016 606

RESEARCH SAFETY VEHICLE CRASH EFFECTIVENESS METHODOLOGY

HS-016 640

SAFETY AND MOTOR VEHICLE EQUIPMENT

HS-016 628

STEERING AND HANDLING CHARACTERISTICS OF A VEHICLE WHEN FAIL-SAFE TIRE IS DEFLATED

HS-016 637

STRUCTURAL AND OCCUPANT PROTECTION SYSTEMS OF THE OPEL SAFETY VEHICLE

HS-016 608

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. SAFETY IMPLICATIONS PANEL REPORT NO. 2

HS-016 500

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL ECONOMY IMPROVEMENT. TRUCK AND BUS PANEL REPORT NO. 7

HS-016 501

THE APPLICATION OF COMPUTER SIMULATIONS IN VEHICLE SAFETY

HS-016 613

THE ESVW 2, VOLKSWAGEN'S EXPERIMENTAL SAFETY VEHICLE

HS-016 565

THE FREQUENCY OF CORRESPONDING VEHICLE DAMAGE IN CRASH TESTS AND ACTUAL ACCIDENTS

HS-016 582

THE RELATION BETWEEN VEHICLE HANDLING AND ACCIDENT AVOIDANCE

HS-016 626

THE ROLE OF VEHICLE HANDLING IN ACCIDENT CAUSATION

HS-016 692

TYPE AND CONDITION OF THE VEHICLE

HS-016 666

VEHICLE COMPATIBILITY IN CAR-TO-CAR SIDE IMPACTS AND PEDESTRIAN-TO-CAR FRONTAL IMPACTS

HS-016 612

VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 2 -- ANALYSIS OF ACCIDENT INFORMATION. FINAL REPORT

HS-801 542

VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON A MOCK VEHICLE EXTERIOR. FINAL REPORT

HS-801 544

VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF A CRASH VICTIM -- EXTENSION AND VALIDATION STUDY. FINAL REPORT

HS-801 547

A PRACTICAL APPROACH TO THE PROTECTION OF MOTOR VEHICLES BY THE ABSORPTION [ABSORPTION] OF IMPACT ENERGY

HS-016 620

COMPATIBILITY BETWEEN VEHICLES IN FRONTAL AND SEMI-FRONTAL COLLISIONS

HS-016 605

DIESELIZATION OF LIGHT AND MEDIUM DUTY COMMERCIAL VEHICLES IN JAPAN

HS-016 552

DRIVER-VEHICLE CONTROL AND PERFORMANCE IN THE PRESENCE OF AERODYNAMIC DISTURBANCES FROM LARGE VEHICLES

HS-016 651

ELECTRONIC EQUIPMENT EARNING ITS PLACE ON EUROPEAN VEHICLES

HS-016 521

ELECTRONIC EQUIPMENT USAGE ON JAPANESE VEHICLES

HS-016 522

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS. PT. 2. EUROPEAN EXPERIMENTAL VEHICLES COMMITTEE

HS-016 560

INTERNATIONAL TECHNICAL CONFERENCE ON EXPERIMENTAL SAFETY VEHICLES (5TH), LONDON, ENGLAND, JUNE 4-7, 1974

HS-016 557

PAST AND CONTEMPORARY TRENDS OF COMMERCIAL VEHICLES IN JAPAN AS VIEWED BY FLEET OWNER

HS-016 551

SOME METHODS OF ABSORBING THE ENERGY OF MOTOR VEHICLES AND THEIR OCCUPANTS

HS-016 611

THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (GENERAL DESCRIPTION)

HS-016 572

THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (SUMMARY OF TOYOTA ESV TEST)

HS-016 573

THE TEST OF JAPANESE EXPERIMENTAL VEHICLES (SUMMARY OF NISSAN ESV TEST)

HS-016 574

VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTER VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON THE DIRECTIONAL DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)

HS-016 504

## VERGLEICH

VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTER VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON THE DIRECTIONAL DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)

HS-016 504

## VERTICAL

A MODEL ANALYSIS OF THE STRUCTURAL AND PNEUMATIC CONTRIBUTIONS TO TIRE BEHAVIOR UNDER VERTICAL LOADS

## VEHICLES

A FEASIBILITY STUDY ON SMALL SAFETY VEHICLES

October 31, 1975

#### **VICTIM**

VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 5-A 3-D MATH SIMULATION OF A CRASH VICTIM -- EXTENSION AND VALIDATION STUDY. FINAL REPORT

HS-801 547

#### **VICTIMS**

AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 1. ENGINEERING MANUAL. FINAL REPORT

HS-801 507

AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2. MODEL VALIDATION. FINAL REPORT

HS-801 508

AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 3. USER MANUAL. FINAL REPORT

HS-801 509

AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 4. PROGRAMMERS MANUAL. FINAL REPORT

HS-801 510

#### **VIEWED**

PAST AND CONTEMPORARY TRENDS OF COMMERCIAL VEHICLES IN JAPAN AS VIEWED BY FLEET OWNER

HS-016 551

#### **VIEWPOINT**

AUTO ELECTRONICS: A SEMICONDUCTOR SUPPLIER'S VIEWPOINT

HS-016 523

THE PUNCTURED PNEUMATIC CAR TIRE FROM THE USER'S VIEWPOINT

HS-016 635

#### **VIOLATIONS**

PERSONALITY AND TEMPERAMENT DIFFERENCES BETWEEN ALCOHOLICS WITH HIGH AND LOW RECORDS OF TRAFFIC ACCIDENTS AND VIOLATIONS

HS-016 696

#### **VISCOELASTIC**

NONLINEAR WAVE PROPAGATION IN VISCOELASTIC TUBES: APPLICATION TO AORTIC RUPTURE

HS-016 676

#### **VISIBILITY**

DEVELOPMENT OF A COMPUTER SIMULATION TO PREDICT THE VISIBILITY DISTANCE PROVIDED BY HEADLAMP BEAMS

HS-016 647

THE STOP LAMP: SOME OPTIMUM VISIBILITY CONSIDERATIONS

HS-016 631

#### **VOLKSWAGEN**

THE ESVW 2. VOLKSWAGEN'S EXPERIMENTAL SAFETY VEHICLE

HS-016 565

#### **VOLUNTEER**

RELATING AIR CUSHION PERFORMANCE TO HUMAN FACTORS AND TOLERANCE LEVELS. PT. 3-- HUMAN VOLUNTEER TESTING

HS-016 589

#### **WARNING**

FEASIBILITY STUDY OF IN-VEHICLE WARNING SYSTEMS. FINAL REPORT

HS-801 569

#### **WAVE**

NONLINEAR WAVE PROPAGATION IN VISCOELASTIC TUBES: APPLICATION TO AORTIC RUPTURE

HS-016 676

#### **WEIGHT**

EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE, CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR CRASHES

HS-016 577

#### **WHEEL**

AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF WHEEL SPIN-DOWN AND OTHER VARIABLES. FINAL REPORT

HS-016 700

DEATH OFTEN RIDES AT THE WHEEL OF THE DROWSY DRIVER

HS-016 673

FRONT WHEEL DRIVE IN AMERICA

HS-016 697

#### **WHEELS**

FAKTORER SOM MEDVERKAR TILL LAG FRIKTION MELLAN BILDACK OCH VAGBANA (FACTORS CONTRIBUTING TO LOW FRICTION BETWEEN WHEELS AND ROAD SURFACE)

HS-016 703

#### **WIND**

THE INFLUENCE OF WIND TUNNEL SOLID BOUNDARIES ON AUTOMOTIVE TEST DATA

HS-016 547

#### **WINDSHIELD**

REDUCED LACERATION FROM A NEW LAMINATED WINDSHIELD

HS-016 597

#### **WIRING**

A CASE FOR STANDARDIZATION [TRUCK WIRING]

HS-016 684

#### **WISCONSIN**

THINKING TWICE ABOUT HIGHWAY SAFETY. [WISCONSIN] GOVERNOR'S CONFERENCE ON

EXPOSURE AND EXPERIENCE [YOUNG DRIVER ACCIDENTS]

HS-016 665

YOUNG DRIVER ACCIDENTS. A REPORT PREPARED BY AN OECD ROAD RESEARCH GROUP

HS-016 663

YOUNG DRIVER ACCIDENTS. APPENDICES.

HS-016 672

YOUNG DRIVERS: THE PROBLEM

HS-016 664

## ZUM

VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTER VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON THE DIRECTIONAL DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)

HS-016 504



# Author Index

- Kampen, L. T. B.**  
LAP BELTS AND 3-POINT BELTS: A COMPARISON  
OF EFFECTIVENESS  
HS-016 681
- Bertson, W. C.**  
VOLUME AND TEMPERATURE INFLUENCES ON  
THE EFFECTIVENESS OF LEAN THERMAL REAC-  
TORS  
HS-016 687
- exander, G. J.**  
POSITIVE GUIDANCE IN TRAFFIC CONTROL  
HS-016 698
- abia, A.**  
DESIGN AND OPERATION OF EUROPEAN TRUCKS  
FOR MAXIMUM FUEL ECONOMY  
HS-016 691
- ustin, J. A.**  
MULTIDISCIPLINARY ACCIDENT INVESTIGATION  
PROGRAM. FINAL REPORT  
HS-801 515  
STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISION. VOL. 1. FINAL REPORT  
HS-801 519  
STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISIONS. VOL. 2. FINAL REPORT  
HS-801 520
- ramidis, S. A.**  
MEASUREMENT OF AUTOMOTIVE TIMING CHAIN  
DRIVE LOADS  
HS-016 548
- gdiss, B. J.**  
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL  
COUNTERMEASURES. FINAL REPORT  
HS-801 436
- alasubramanian, K. N.**  
A THEORETICAL AND EXPERIMENTAL INVESTIGA-  
TION OF AUTOMOBILE PATH DEVIATIONS WHEN  
DRIVER STEERS WITH NO VISUAL INPUT  
HS-016 653
- ilban, M. S.**  
ELECTRONIC FAULT MONITORING AND DIAGNOSIS  
IN AIR BAG SYSTEMS  
HS-016 535
- anholzer, D.**  
IMPROVING DIRECTIONAL STABILITY UNDER  
BRAKING  
HS-016 629
- arnes-Moss, H. W.**  
ENGINE DESIGN FOR THE FUTURE  
HS-016 555
- arnett, C.**  
ONE TOO MANY FOR THE ROAD (DRINKING  
DRIVERS)  
HS-016 512
- Becker, J. M.**  
DEVELOPMENT OF A COMPUTER SIMULATION TO  
PREDICT THE VISIBILITY DISTANCE PROVIDED BY  
HEADLAMP BEAMS  
HS-016 647
- Bertodo, R.**  
EVOLUTION OF A NEW COMBUSTION SYSTEM FOR  
DIESEL EMISSION CONTROL  
HS-016 683
- Bettes, W. H.**  
THE INFLUENCE OF WIND TUNNEL SOLID BOUN-  
DARIES ON AUTOMOTIVE TEST DATA  
HS-016 547
- Bhatt, K. U.**  
GUIDELINES ON THE OPERATION OF SUBSCRIP-  
TION BUS SERVICES  
HS-016 538
- Bigelow, J. H.**  
ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL  
COUNTERMEASURES; PHASE 1: HIGH RISK DRIVER  
STUDY PLAN. REPORT  
HS-801 433
- Bisimis, E.**  
VERGLEICH EINIGER RECHEN- UND MESSERGEB-  
NISSE ZUM FAHRVERHALTER VON SATTELZUGEN  
(COMPARISON OF SOME THEORETICAL AND EX-  
PERIMENTAL RESULTS ON THE DIRECTIONAL  
DYNAMICS OF TRACTOR- SEMITRAILER VEHICLES)  
HS-016 504
- Bjerkklie, J. W.**  
EMISSIONS CONTROL OF ENGINE SYSTEMS. CON-  
SULTANT REPORT  
HS-016 498
- Bluet, J. C.**  
THE ROAD SAFETY CHECKLIST--A PERIODICAL  
INQUIRY REGARDING TRAFFIC  
HS-016 581
- Boike, R. J.**  
ELECTRONIC DISPLAY APPLICATIONS IN INSTRU-  
MENT PANEL DESIGN  
HS-016 530
- BouFaissal, J.**  
WHAT IS A MICROPROCESSOR?  
HS-016 524
- Bowler, L. L.**  
PROGRESS IN AUTOMOTIVE ELECTRONICS  
HS-016 520
- Boyer, D. S.**  
FEASIBILITY STUDY OF IN-VEHICLE WARNING  
SYSTEMS. FINAL REPORT  
HS-801 569
- Brattain, R. R.**  
FIELD PERFORMANCE OF EMISSIONS-CON-  
TROLLED AUTOMOBILES. CONSULTANT REPORT  
TO THE COMMITTEE ON MOTOR VEHICLE EMIS-

**Brogan, J. J.**  
AN OVERVIEW OF THE U.S. GOVERNMENT PRO-  
GRAMS TO EVALUATE ALTERNATIVE POWER-  
PLANTS TO THE CONVENTIONAL INTERNAL COM-  
BUSTION ENGINES FOR AUTOMOBILES  
HS-016 639

**Brown, B. F.**  
ENVIRONMENTALLY ASSISTED FRACTURING:  
RESEARCH AND STANDARDS  
HS-016 721

**Browne, A. L., ed.**  
THE PHYSICS OF TIRE TRACTION. THEORY AND  
EXPERIMENT  
HS-016 516

**Bryner, G.**  
STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISION. VOL. 1. FINAL REPORT  
HS-801 519  
STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISIONS. VOL. 2. FINAL REPORT  
HS-801 520

**Burg, A.**  
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL  
COUNTERMEASURES. FINAL REPORT  
HS-801 435

**Burland, D.**  
OCCUPANT PROTECTION IN REAR IMPACT  
HS-016 618

**Butler, F. E.**  
AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 1.  
ENGINEERING MANUAL. FINAL REPORT  
HS-801 507  
AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2.  
MODEL VALIDATION. FINAL REPORT  
HS-801 508  
AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 3.  
USER MANUAL. FINAL REPORT  
HS-801 509  
AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 4.  
PROGRAMMERS MANUAL. FINAL REPORT  
HS-801 510

**Campbell, B. J.**  
HIGHWAY SAFETY PROGRAM EVALUATION AND  
RESEARCH  
HS-016 724

**Cantlay, G. F.**  
A CASE FOR STANDARDIZATION [TRUCK WIRING]  
HS-016 684

**Carpenter, J. F.**  
TRAFFIC FATALITIES AND THE ENERGY CRISIS: A  
SECOND FOUR MONTH ANALYSIS MAY - AUG 1974  
HS-016 732

**Chappell, M. J.**  
ENERGY ABSORPTION BY VARIABLE SHEAR  
STRENGTH DUPLEX MATERIALS  
HS-016 616

**Chelsky, T. S.**  
A LABORATORY FATIGUE TEST PROGRAM FOR  
STEERING COMPONENTS BASED ON FIELD LOAD  
DATA  
HS-016 542

**Chiesa, A.**  
EVALUATION OF TIRE ABRASION IN TERMS OF  
DRIVING SEVERITY  
HS-016 706

**Child, J. R.**  
A PRACTICAL APPROACH TO THE PROTECTION OF  
MOTOR VEHICLES BY THE ABSORPTION  
[ABSORPTION] OF IMPACT ENERGY  
HS-016 620

**Clavel, M.**  
[CITROEN EXPERIMENTAL SAFETY VEHICLE PRO-  
GRAM]  
HS-016 563

**Cobb, J.**  
ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL  
COUNTERMEASURES; PHASE 1: HIGH RISK DRIVER  
STUDY PLAN. REPORT  
HS-801 433

**Cohen, R. M.**  
AUTO ELECTRONICS: A SEMICONDUCTOR SUPPLI-  
ER'S VIEWPOINT  
HS-016 523

**Colling, R. L.**  
APPLICATION OF MICROPROCESSORS TO THE AU-  
TOMOBILE  
HS-016 525

**Collins, R.**  
NONLINEAR WAVE PROPAGATION IN  
VISCOELASTIC TUBES: APPLICATION TO AORTIC  
RUPTURE  
HS-016 676

**Compton, C. P., R. L. 0Douglas0j0**  
ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL  
COUNTERMEASURES. FINAL REPORT ON PHASE 1  
HS-801 434

**Creps, W. D.**  
CLOSED LOOP CARBURETOR EMISSION CONTROL  
SYSTEM  
HS-016 533

**Crum, W. B.**  
EFFECTS OF TIRE ROLLING RESISTANCE ON VEHI-  
CLE FUEL CONSUMPTION  
HS-016 675

October 31, 1975

**Danese, G.**

A RESEARCH STUDY FOR AN ENERGY ABSORBING  
SLIDING SEAT

HS-016 610

**Daniels, W. J.**

[THE SAFETY VEHICLE PROGRAM AT BRITISH LEY-  
LAND MOTOR CORPORATION]

HS-016 567

**Danner, M.**

THE FREQUENCY OF CORRESPONDING VEHICLE  
DAMAGE IN CRASH TESTS AND ACTUAL AC-  
CIDENTS

HS-016 582

**Darragh, C. T.**

BRAKESAVER -- CATERPILLAR'S HIGHWAY TRUCK  
RETARDER

HS-016 554

**Davis, S.**

ANALYSIS OF TEST RESULTS FOR AMF/FIAT ESV  
HEAD-ON COLLISION

HS-016 601

**Dearinger, J. A.**

RECREATIONAL VEHICLE ACCIDENT INVESTIGA-  
TION STUDY. INTERIM REPORT

HS-801 523

**Deutsch, K.**

THE ROLE OF EXTRUSION DEVICES IN ENERGY  
ABSORPTION FOR SAFETY

HS-016 614

**Devlin, S. S.**

DESIGN CONSIDERATIONS FOR AN ON-BOARD  
COMPUTER SYSTEM

HS-016 527

**DeEskinazi, J.**

CONTACT OF AN INFLATED TOROIDAL MEMBRANE  
WITH A FLAT SURFACE AS AN APPROACH TO THE  
TIRE DEFLECTION PROBLEM

HS-016 678

**Dotson, J. T.**

AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF  
WHEEL SPIN-DOWN AND OTHER VARIABLES.  
FINAL REPORT

HS-016 700

**Douglas, W.**

ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL  
COUNTERMEASURES. FINAL REPORT

HS-801 436

**Downes, T. W. E.**

EVOLUTION OF A NEW COMBUSTION SYSTEM FOR  
DIESEL EMISSION CONTROL

HS-016 683

**Duclos, P.**

PEDESTRIAN PROTECTION

HS-016 591

**Dunlap, D. F.**

LARGE-TRUCK ACCIDENTS INVOLVING TIRE  
FAILURE

**Eberhard, J. W.**

OVERVIEW OF NHTSA RESEARCH ACTIVITIES IN  
DRIVER EDUCATION AND LICENSING

HS-016 658

**Ebner, M.**

MANUFACTURABILITY AND COSTS OF PROPOSED  
LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS.  
CONSULTANT REPORT

HS-016 502

**Edelman, A.**

LAP BELTS AND 3-POINT BELTS: A COMPARISON  
OF EFFECTIVENESS

HS-016 681

**Edwards, J. J.**

RESEARCH SAFETY VEHICLE CRASH EFFECTIVE-  
NESS METHODOLOGY

HS-016 640

**Egglestone, W.**

OCCUPANT PROTECTION IN FRONTAL IMPACTS: A  
STATIC, PASSIVE RESTRAINT SYSTEM

HS-016 617

**Eiswirth, R. S.**

A CONTROLLED STUDY OF THE EFFECT OF  
TELEVISION MESSAGES ON SAFETY BELT USE

HS-016 723

**Elsbolz, J.**

RELATIONSHIP BETWEEN VEHICLE FRONT-END  
DEFORMATION AND EFFICIENCY OF SAFETY  
BELTS DURING FRONTAL IMPACT

HS-016 606

**Elson, M. G. J.**

THE ROLE OF EXTRUSION DEVICES IN ENERGY  
ABSORPTION FOR SAFETY

HS-016 614

**Emmerson, W. C.**

THE APPLICATION OF COMPUTER SIMULATIONS IN  
VEHICLE SAFETY

HS-016 613

**Enke, K.**

THE RELATION BETWEEN VEHICLE HANDLING  
AND ACCIDENT AVOIDANCE

HS-016 626

**Eposito, V. J.**

ACCIDENT DATA COLLECTION, ANALYSIS AND  
FINDINGS

HS-016 670

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 1. UNITED  
STATES

HS-016 558

**Fales, E. D. , Jr.**

READING THE HIGHWAY...FIGHTING FATIGUE

HS-016 508

**Fayon, A.**

AN OBJECTIVE ANALYSIS OF THE PROTECTION OF-  
FERED BY ACTIVE AND PASSIVE RESTRAINT  
SYSTEMS

HS-016 693

- PEDESTRIAN PROTECTION**  
HS-016 591
- Fell, J.**  
ACCIDENT DATA COLLECTION, ANALYSIS AND FINDINGS  
HS-016 670
- Fiala, E.**  
BENEFIT/COST ANALYSIS AS A BASIS FOR DECISIONS IN THE AUTOMOTIVE INDUSTRY  
HS-016 641
- Filkins, L. D.**  
ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT ON PHASE 1  
HS-801 434
- Finch, P. M.**  
BRITISH LEYLAND/TRRL EXPERIMENTAL SAFETY SYSTEMS CONTRACT  
HS-016 566  
VEHICLE COMPATIBILITY IN CAR-TO-CAR SIDE IMPACTS AND PEDESTRIAN-TO-CAR FRONTAL IMPACTS  
HS-016 612
- Fisher, F. W.**  
CAB CONDITION -- HEATING AND COOLING--HEAVY DUTY TRUCK AND OFF-HIGHWAY EQUIPMENT  
HS-016 694
- Fitzpatrick, M.**  
DEVELOPMENT OF AN ADVANCED PASSIVE RESTRAINT SYSTEM FOR SUBCOMPACT CAR DRIVERS. FINAL REPORT  
HS-801 528
- Fleck, J. T.**  
AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 1. ENGINEERING MANUAL. FINAL REPORT  
HS-801 507  
AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2. MODEL VALIDATION. FINAL REPORT  
HS-801 508  
AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 3. USER MANUAL. FINAL REPORT  
HS-801 509  
AN IMPROVED THREE DIMENSIONAL COMPUTER SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 4. PROGRAMMERS MANUAL. FINAL REPORT  
HS-801 510
- Flexer, M.**  
EMERGENCY SERVICES. WHAT POTENTIAL FOR HELICOPTERS IN EMS?
- Foreman, J. A.**  
FUNDAMENTALS OF AUTOMOTIVE ELECTRICAL DISTRIBUTION  
HS-016 536
- Fowler, J. E.**  
THE APPLICATION OF COMPUTER SIMULATIONS IN VEHICLE SAFETY  
HS-016 613
- French, T.**  
SAFETY ASPECTS OF DENOVO RUN FLAT TIRES  
HS-016 632
- Garrett, J. W.**  
FACTORS INFLUENCING THE PERFORMANCE OF THE ENERGY ABSORBING STEERING COLUMN IN ACCIDENTS  
HS-016 578
- Garrett, K.**  
ENGINE SILENCING--CHANGES IN EMPHASIS  
HS-016 513
- Gay, H. A.**  
MANUFACTURABILITY AND COSTS OF PROPOSED LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS. CONSULTANT REPORT  
HS-016 502
- Ghilardi, G.**  
EVALUATION OF TIRE ABRASION IN TERMS OF DRIVING SEVERITY  
HS-016 706
- Gockel, J. L.**  
FIELD PERFORMANCE OF EMISSIONS-CONTROLLED AUTOMOBILES. CONSULTANT REPORT TO THE COMMITTEE ON MOTOR VEHICLE EMISSIONS. COMMISSION ON SOCIOTECHNICAL SYSTEMS, NATIONAL RESEARCH COUNCIL  
HS-016 514
- Goldstein, L.**  
ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES; PHASE 1: HIGH RISK DRIVER STUDY PLAN. REPORT  
HS-801 433
- Golomb, D. H.**  
AN AID ANALYSIS OF TEXAS TRAFFIC ACCIDENT DATA BEFORE AND DURING THE ENERGY CRISIS.  
HS-016 682
- Gorille, I.**  
BOSCH ELECTRONIC FUEL INJECTION WITH CLOSED LOOP CONTROL  
HS-016 532
- Grant, J. W.**  
A TECHNIQUE FOR THE VALIDATION OF VEHICLE MODELS USING THE ROAD SIMULATOR

- Gray, J. M.**  
PRESENT STATUS OF COLD-ROLLED HIGH  
STRENGTH STEEL DEVELOPMENT  
HS-016 544
- Grayson, G. B.**  
THE HAMPSHIRE CHILD PEDESTRIAN ACCIDENT  
STUDY  
HS-016 674
- Haddon, J. Jr.**  
EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE,  
CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR  
CRASHES  
HS-016 577
- Haddon, W. , Jr.**  
A CONTROLLED STUDY OF THE EFFECT OF  
TELEVISION MESSAGES ON SAFETY BELT USE  
HS-016 723
- Hagen, R. E.**  
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL  
COUNTERMEASURES. FINAL REPORT  
HS-801 435
- Harris, D. H.**  
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL  
COUNTERMEASURES. FINAL REPORT  
HS-801 435
- Hartemann, F.**  
AN OBJECTIVE ANALYSIS OF THE PROTECTION OF-  
FERED BY ACTIVE AND PASSIVE RESTRAINT  
SYSTEMS  
HS-016 693
- Haslegrave, C. M.**  
PERFORMANCE MEASUREMENTS ON THE OPAT  
DUMMY  
HS-016 594
- Hayes, G. G.**  
DETERMINATION OF MOTOR VEHICLE CHARAC-  
TERISTICS AFFECTING DRIVER HANDLING PER-  
FORMANCE  
HS-016 624
- Hays, D. F. , ed.**  
THE PHYSICS OF TIRE TRACTION. THEORY AND  
EXPERIMENT  
HS-016 516
- Hellriegel, E.**  
THE FORD AUTOMATIC SAFETY BELT SYSTEM  
HS-016 607
- Hendricks, D. L.**  
FACTORS INFLUENCING THE PERFORMANCE OF  
THE ENERGY ABSORBING STEERING COLUMN IN  
ACCIDENTS  
HS-016 578
- Hencin, N. A.**  
EMISSIONS CONTROL OF ENGINE SYSTEMS. CON-  
SULTANT REPORT  
HS-016 498
- Higuchi, K.**  
CHARACTERISTICS OF BODY ENERGY ABSORPTION  
AND RESTRAINT SYSTEM  
HS-016 623
- Hirsch, A. E.**  
NHTSA PROGRAMS IN BIOMECHANICS  
HS-016 585
- Hobbs, J. A.**  
SOME PATTERNS AND CAUSES OF INJURY IN CAR  
OCCUPANTS  
HS-016 584
- Hoehn, F. W.**  
A TWO-CHARGE ENGINE CONCEPT: HYDROGEN  
ENRICHMENT  
HS-016 688
- Hoffner, K.**  
TYPE AND CONDITION OF THE VEHICLE  
HS-016 666
- Hogan, A.**  
STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISION. VOL. 1. FINAL REPORT  
HS-801 519
- Hogan, A.**  
STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISIONS. VOL. 2. FINAL REPORT  
HS-801 520
- Holmes, T.**  
SAFETY ASPECTS OF DE NOVO RUN FLAT TIRES  
HS-016 632
- Houseman, J.**  
A TWO-CHARGE ENGINE CONCEPT: HYDROGEN  
ENRICHMENT  
HS-016 688
- Hutchinson, J. W.**  
RECREATIONAL VEHICLE ACCIDENT INVESTIGA-  
TION STUDY. INTERIM REPORT  
HS-801 523
- Iida, T.**  
COST-BENEFIT ANALYSIS OF BUMPER SYSTEMS  
FOR SMALL CARS  
HS-016 644
- Ivey, D. L.**  
AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF  
WHEEL SPIN-DOWN AND OTHER VARIABLES.  
FINAL REPORT  
HS-016 700
- Jacobson, M. A.**  
THE PUNCTURED PNEUMATIC CAR TIRE FROM THE  
USER'S VIEWPOINT  
HS-016 635
- Jehu, V. J.**  
TOWARDS PEDESTRIAN SAFETY  
HS-016 595
- Jensen, R. H.**  
GM-ATD 502 ANTHROPOMORPHIC DUMMY--  
DEVELOPMENT AND EVALUATION  
HS-016 586

EMISSIONS CONTROL OF ENGINE SYSTEMS. CONSULTANT REPORT	HS-016 498	A CONTROLLED STUDY OF THE EFFECT OF TELEVISION MESSAGES ON SAFETY BELT USE	HS-016 723
<b>Johnson, N. B.</b> DEVELOPMENT OF A SCHOOL BUS FUEL SYSTEM INTEGRITY COMPLIANCE PROCEDURE. FINAL REPORT	HS-801 529	RSV, CRASH HAZARDS AND PUBLIC SUPPORT	HS-016 599
<b>Johnson, W. A.</b> MANUFACTURABILITY AND COSTS OF PROPOSED LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS. CONSULTANT REPORT	HS-016 502	<b>Kelly, K. B.</b> THE INFLUENCE OF WIND TUNNEL SOLID BOUNDARIES ON AUTOMOTIVE TEST DATA	HS-016 547
<b>Jokschi,</b> EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE, CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR CRASHES	HS-016 577	<b>Kiefer, E. S.</b> STRUCTURAL AND OCCUPANT PROTECTION SYSTEMS OF THE OPEL SAFETY VEHICLE	HS-016 608
<b>Jones, G.</b> FACTORS LEADING TO LOSS OF CONTROL--A GUIDE FROM ACCIDENT INVESTIGATIONS	HS-016 633	<b>Kihara, R.</b> DIESELIZATION OF LIGHT AND MEDIUM DUTY COMMERCIAL VEHICLES IN JAPAN	HS-016 552
<b>Jones, I. S.</b> THE MECHANICS OF ROLLOVER AS THE RESULT OF CURB IMPACT	HS-016 537	<b>Kirby, R. F.</b> GUIDELINES ON THE OPERATION OF SUBSCRIPTION BUS SERVICES	HS-016 538
THE ROLE OF VEHICLE HANDLING IN ACCIDENT CAUSATION	HS-016 692	<b>Kirkpatrick, R. E.</b> ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL COUNTERMEASURES; PHASE 1: HIGH RISK DRIVER STUDY PLAN. REPORT	HS-801 433
<b>Jones, T. O.</b> APPLICATION OF MICROPROCESSORS TO THE AUTOMOBILE	HS-016 525	<b>Kittrell, J.</b> MANUFACTURABILITY AND COSTS OF PROPOSED LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS. CONSULTANT REPORT	HS-016 502
PROGRESS IN AUTOMOTIVE ELECTRONICS	HS-016 520	<b>Kivity, Y.</b> NONLINEAR WAVE PROPAGATION IN VISCOELASTIC TUBES: APPLICATION TO AORTIC RUPTURE	HS-016 676
<b>Joseph, A.</b> HOW CONSCIOUS ARE YOUR DRIVING HABITS?	HS-016 720	<b>Klein, R. H.</b> DRIVER/VEHICLE RESPONSE RESEARCH	HS-016 625
<b>Jost, E. M.</b> EMISSIONS CONTROL OF ENGINE SYSTEMS. CONSULTANT REPORT	HS-016 498	<b>Klems, G. J.</b> PRESENT STATUS OF COLD-ROLLED HIGH STRENGTH STEEL DEVELOPMENT	HS-016 544
<b>Kaestner, N. F.</b> HIGHWAY SAFETY PROGRAMS: HOW DO WE KNOW THEY WORK? NORTH CAROLINA SYMPOSIUM ON HIGHWAY SAFETY, RALEIGH, SPRING, 1974. VOL. 10	HS-016 648	<b>Klocker, K. J.</b> SINGLE-CYLINDER STUDY OF STRATIFIED CHARGE PROCESS WITH PRECHAMBER-INJECTION	HS-016 685
<b>Karpov, V. P.</b> FLAME PROPAGATION IN AN EDDY COMBUSTION CHAMBER	HS-016 690	<b>Kossar, J. M.</b> BIG AND LITTLE CAR COMPATIBILITY	HS-016 602
<b>Keller, M. , ed.</b> ALCOHOL AND HEALTH. SECOND SPECIAL REPORT TO THE U. S. CONGRESS, JUNE 1974, FROM THE SECRETARY OF HEALTH, EDUCATION, AND WELFARE. NEW KNOWLEDGE	HS-016 540	<b>Kunii, K.</b> COMBUSTION CHARACTERISTICS OF THE TORCH IGNITED ENGINE	HS-016 686

- Lahiff, J. E.**  
VOLUME AND TEMPERATURE INFLUENCES ON  
THE EFFECTIVENESS OF LEAN THERMAL REAC-  
TORS  
HS-016 687
- Lammert, W. F.**  
VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON  
A MOCK VEHICLE EXTERIOR. FINAL REPORT  
HS-801 544
- Lange, J. T.**  
FLEXIBLE EXTERIOR AUTOMOTIVE TRIM  
HS-016 603
- Langwieder, K.**  
THE FREQUENCY OF CORRESPONDING VEHICLE  
DAMAGE IN CRASH TESTS AND ACTUAL AC-  
CIDENTS  
HS-016 582
- Laurance, N. L.**  
DESIGN CONSIDERATIONS FOR AN ON-BOARD  
COMPUTER SYSTEM  
HS-016 527
- Lefferts, P.**  
A NEW INTERFACING CONCEPT: THE MONOLITHIC  
TEMPERATURE TRANSDUCER  
HS-016 549
- Leichtle, I. J.**  
DESIGN AND TEST OF PICKUP TRUCK BOX COVER  
HS-016 545
- Lemberg, G. P.**  
ELECTRONIC EQUIPMENT USAGE ON JAPANESE  
VEHICLES  
HS-016 522
- LeGarde, J.C.**  
AN ANALYSIS OF FARM EQUIPMENT ACCIDENTS  
ON NORTH CAROLINA PUBLIC ROADS  
HS-016 499
- Lilja, B.**  
FAKTORER SOM MEDVERKAR TILL LAG FRIKTION  
MELLAN BILDACK OCH VAGBANA (FACTORS CON-  
TRIBUTING TO LOW FRICTION BETWEEN WHEELS  
AND ROAD SURFACE)  
HS-016 703
- Lincke, W.**  
THE ESVW 2, VOLKSWAGEN'S EXPERIMENTAL  
SAFETY VEHICLE  
HS-016 565
- Lindgren, L. H.**  
MANUFACTURABILITY AND COSTS OF PROPOSED  
LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS.  
CONSULTANT REPORT  
HS-016 502
- Lockie, D. A.**  
THE ROPS SAGA: OSHA SAYS ROLL-OVERS MUST  
BE SAFE  
HS-016 717
- Lohr, F.**  
OPEL'S SAFETY DEVELOPMENT PROGRESS REPORT  
HS-016 564
- Lottman, T. J.**  
PERSONALITY AND TEMPERAMENT DIFFERENCES  
BETWEEN ALCOHOLICS WITH HIGH AND LOW  
RECORDS OF TRAFFIC ACCIDENTS AND VIOLA-  
TIONS  
HS-016 696
- Lowne, R. W.**  
HUMAN INJURY TOLERANCE LEVEL DETERMINA-  
TION FROM ACCIDENT DATA USING THE OPAT  
DUMMY  
HS-016 590
- Lubin, M. J.**  
THE ROLL OF CONNECTING NOZZLE AND THE  
FLAME INITIATION POINT IN THE PERFORMANCE  
OF A DUAL CHAMBER STRATIFIED CHARGE EN-  
GINE  
HS-016 689
- Lundstrom, L. C.**  
RELATING AIR CUSHION PERFORMANCE TO  
HUMAN FACTORS AND TOLERANCE LEVELS. PT. 1.-  
PROGRAM DEVELOPMENT  
HS-016 587
- Lunenfeld, H.**  
POSITIVE GUIDANCE IN TRAFFIC CONTROL  
HS-016 698
- Macaulay, M. A.**  
PERFORMANCE MEASUREMENTS ON THE OPAT  
DUMMY  
HS-016 594
- Macchitelli, F. J.**  
PERSONALITY AND TEMPERAMENT DIFFERENCES  
BETWEEN ALCOHOLICS WITH HIGH AND LOW  
RECORDS OF TRAFFIC ACCIDENTS AND VIOLA-  
TIONS  
HS-016 696
- Maki, M. J.**  
PERSONALITY AND OTHER PERSON-CENTRED  
CHARACTERISTICS  
HS-016 668
- Malany, L. L.**  
BASIC TRAINING PROGRAM FOR DRIVER LICENSE  
EXAMINERS: CONCEPTS AND RECOMMENDATIONS  
-- FINAL REPORT  
HS-801 517
- Manger, H.**  
SAFETY AND MOTOR VEHICLE EQUIPMENT  
HS-016 628
- Mangrulkar, S. M.**  
ENGINE CONTROL BY AN ON-BOARD COMPUTER  
HS-016 526

- Marek, J.**  
YOUNG DRIVERS: THE PROBLEM  
HS-016 664
- Margolin, A. D.**  
FLAME PROPAGATION IN AN EDDY COMBUSTION CHAMBER  
HS-016 690
- Marks, H.**  
TRAFFIC CIRCULATION PLANNING FOR COMMUNITIES  
HS-016 712
- Maxwell, C. R.**  
MANUFACTURABILITY AND COSTS OF PROPOSED LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS. CONSULTANT REPORT  
HS-016 502
- Mayyasi, A. M.**  
VEHICLE EXTERIORS AND PEDESTRIAN INJURY PREVENTION. VOL. 2 -- ANALYSIS OF ACCIDENT INFORMATION. FINAL REPORT  
HS-801 542
- McBride, R. S.**  
SAFE PERFORMANCE CURRICULUM FOR SECONDARY SCHOOL DRIVER EDUCATION: PROGRAM DEVELOPMENT, IMPLEMENTATION, AND TECHNICAL FINDINGS. FINAL REPORT  
HS-801 491
- McDowell, D. J.**  
FIELD PERFORMANCE OF EMISSIONS-CONTROLLED AUTOMOBILES. CONSULTANT REPORT TO THE COMMITTEE ON MOTOR VEHICLE EMISSIONS. COMMISSION ON SOCIOTECHNICAL SYSTEMS, NATIONAL RESEARCH COUNCIL  
HS-016 514
- McLean, W. J.**  
EMISSIONS CONTROL OF ENGINE SYSTEMS. CONSULTANT REPORT  
HS-016 498
- McNall, R. G.**  
EFFECTS OF TIRE ROLLING RESISTANCE ON VEHICLE FUEL CONSUMPTION  
HS-016 675
- Mela, D. F.**  
NHTSA'S EVALUATION OF AIR CUSHION RESTRAINT SYSTEM EFFECTIVENESS (ACRS)  
HS-016 579
- Melvin, J. W.**  
HUMAN TOLERANCE RESEARCH PROGRAM. FIRST YEAR INTERIM REPORT  
HS-016 506
- THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES) VOL. 1 EXECUTIVE SUMMARY. FINAL REPORT**
- THORACIC MODEL IMPROVEMENTS (EXPERIMENTAL TISSUE PROPERTIES). VOLUME 3, LITERATURE SURVEY. FINAL REPORT**  
HS-801 559
- Middlemiss, I. D.**  
EVOLUTION OF A NEW COMBUSTION SYSTEM FOR DIESEL EMISSION CONTROL  
HS-016 683
- Mikami, Y.**  
DIESELIZATION OF LIGHT AND MEDIUM DUTY COMMERCIAL VEHICLES IN JAPAN  
HS-016 552
- Millman, R. S.**  
ENERGY ABSORPTION BY VARIABLE SHEAR STRENGTH DUPLEX MATERIALS  
HS-016 616
- Mills, R.**  
EXPOSURE AND EXPERIENCE [YOUNG DRIVER ACCIDENTS]  
HS-016 665
- Misek, B. J.**  
DESIGN SOLUTIONS FOR TEMPERATURE SENSING IN DIFFICULT AUTOMOTIVE APPLICATIONS  
HS-016 550
- Mitschke, M.**  
VERGLEICH EINIGER RECHEN- UND MESSERGEBNISSE ZUM FAHRVERHALTER VON SATTELZUGEN (COMPARISON OF SOME THEORETICAL AND EXPERIMENTAL RESULTS ON THE DIRECTIONAL DYNAMICS OF TRACTOR-SEMITRAILER VEHICLES)  
HS-016 504
- Montanari, V.**  
FIAT TECHNICAL PRESENTATION  
HS-016 570
- Moore, M., ed.**  
DRIVER PERFORMANCE. TRANSPORTATION RESEARCH RECORD 520  
HS-016 650
- FUTURE ROLE OF DRIVER LICENSING IN HIGHWAY SAFETY**  
HS-016 655
- Moore, R. W.**  
THE ROLE OF EXTRUSION DEVICES IN ENERGY ABSORPTION FOR SAFETY  
HS-016 614
- Mori, H.**  
TYPE AND CONDITION OF THE VEHICLE  
HS-016 666
- Morrow, G. W.**  
DEVELOPMENT OF A SCHOOL BUS FUEL SYSTEM INTEGRITY COMPLIANCE PROCEDURE. FINAL REPORT  
HS-016 529



October 31, 1975

- Moyer, D. F.**  
ENGINE CONTROL BY AN ON-BOARD COMPUTER  
HS-016 526
- Mozdzierz, G. J.**  
PERSONALITY AND TEMPERAMENT DIFFERENCES  
BETWEEN ALCOHOLICS WITH HIGH AND LOW  
RECORDS OF TRAFFIC ACCIDENTS AND VIOLA-  
TIONS  
HS-016 696
- Muhlrاد, N.**  
COST-EFFECTIVENESS STUDY  
HS-016 642
- Nagakuna, M.**  
TRAFFIC ACCIDENTS IN JAPAN  
HS-016 575
- Nakagawa, Y.**  
COMBUSTION CHARACTERISTICS OF THE TORCH  
IGNITED ENGINE  
HS-016 686
- Neilson, I. D.**  
ACCIDENT INVESTIGATION AS AN AID TO  
PLANNING THE FUTURE OF CAR SAFETY  
HS-016 583
- Newhall, H. K.**  
EMISSIONS CONTROL OF ENGINE SYSTEMS. CON-  
SULTANT REPORT  
HS-016 498
- Newton, D. A.**  
THE DUNLOP MK 2 COMPOSITE ENERGY ABSORB-  
ING BUMPER SYSTEM  
HS-016 615
- Nicholson, D. W.**  
A MODEL ANALYSIS OF THE STRUCTURAL AND  
PNEUMATIC CONTRIBUTIONS TO TIRE BEHAVIOR  
UNDER VERTICAL LOADS  
HS-016 677
- Nissley, H.**  
ELECTRONIC DISPLAY APPLICATIONS IN INSTRU-  
MENT PANEL DESIGN  
HS-016 530
- Nolan, J. F.**  
SURVEY OF ELECTRONIC DISPLAYS  
HS-016 528
- O'Day, J.**  
A PROPOSED NEW NATIONAL SYSTEM FOR COL-  
LECTING MULTIPURPOSE ACCIDENT DATA: SIR  
HS-016 576  
A SAMPLING PROGRAM FOR EVALUATION OF THE  
1974 RESTRAINT SYSTEMS  
HS-016 699  
AN AID ANALYSIS OF TEXAS TRAFFIC ACCIDENT  
DATA BEFORE AND DURING THE ENERGY CRISIS.  
HS-016 682  
LARGE-TRUCK ACCIDENTS INVOLVING TIRE  
FAILURE  
HS-016 515
- O'Neill, B.**  
A CONTROLLED STUDY OF THE EFFECT OF  
TELEVISION MESSAGES ON SAFETY BELT USE  
HS-016 723  
EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE,  
CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR  
CRASHES  
HS-016 577
- Ohlsson, E.**  
FAKTORER SOM MEDVERKAR TILL LAG FRIKTION  
MELLAN BILDACK OCH VAGBANA (FACTORS CON-  
TRIBUTING TO LOW FRICTION BETWEEN WHEELS  
AND ROAD SURFACE)  
HS-016 703
- Okami, Y.**  
THE TEST OF JAPANESE EXPERIMENTAL VEHI-  
CLES (GENERAL DESCRIPTION)  
HS-016 572  
THE TEST OF JAPANESE EXPERIMENTAL VEHI-  
CLES (SUMMARY OF TOYOTA ESV TEST)  
HS-016 573  
THE TEST OF JAPANESE EXPERIMENTAL VEHI-  
CLES (SUMMARY OF NISSAN ESV TEST)  
HS-016 574
- Olsen, R. A.**  
IS THERE A SELECTION RATIO IN THE FUTURE OF  
LICENSING?  
HS-016 662
- Osselet, A.**  
APPLICATION TO REGULATIONS OF STUDIES MADE  
PURSUANT TO THE ESV PROGRAM  
HS-016 645
- Oswald, R. S.**  
DESIGN CONSIDERATIONS FOR AN ON-BOARD  
COMPUTER SYSTEM  
HS-016 527
- Overton, T. S.**  
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL  
COUNTERMEASURES. FINAL REPORT  
HS-801 436
- Owen, C. J.**  
A CASE FOR STANDARDIZATION [TRUCK WIRING]  
HS-016 684
- Peltzman, S.**  
THE EFFECTS OF AUTOMOBILE SAFETY REGULA-  
TION  
HS-016 511
- Pendleton, J. T.**  
BASIC TRAINING PROGRAM FOR DRIVER LICENSE  
EXAMINERS: CONCEPTS AND RECOMMENDATIONS  
-- FINAL REPORT  
HS-801 517
- Perini, V. J. , Jr.**  
DRIVER LICENSING LAW: HELP OR HINDRANCE?  
HS-016 657

**Persicke, G.**

A PRACTICAL APPROACH TO THE PROTECTION OF  
MOTOR VEHICLES BY THE ABSORPTION  
[ABSORPTION] OF IMPACT ENERGY

HS-016 620

**Peterson, D. D.**

FEASIBILITY STUDY OF IN-VEHICLE WARNING  
SYSTEMS. FINAL REPORT

HS-801 569

**Pickard, J.**

REDUCED LACERATION FROM A NEW LAMINATED  
WINDSHIELD

HS-016 597

**Pischinger, F. F.**

SINGLE-CYLINDER STUDY OF STRATIFIED CHARGE  
PROCESS WITH PRECHAMBER-INJECTION

HS-016 685

**Planek, T. W.**

PERSONALITY AND TEMPERAMENT DIFFERENCES  
BETWEEN ALCOHOLICS WITH HIGH AND LOW  
RECORDS OF TRAFFIC ACCIDENTS AND VIOLA-  
TIONS

HS-016 696

**Plant, F. I.**

A PRACTICAL APPROACH TO THE PROTECTION OF  
MOTOR VEHICLES BY THE ABSORPTION  
[ABSORPTION] OF IMPACT ENERGY

HS-016 620

**Pooch, U. W.**

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 2 - ANALYSIS OF ACCIDENT IN-  
FORMATION. FINAL REPORT

HS-801 542

**Potter, R. A.**

GM-ATD 502 ANTHROPOMORPHIC DUMMY--  
DEVELOPMENT AND EVALUATION

HS-016 586

**Prentice, H. A. J.**

DRIVERS' LIMITATIONS

HS-016 634

**Prigogine, J.**

PERSONALITY AND OTHER PERSON-CENTRED  
CHARACTERISTICS

HS-016 668

**Quenault, S. W.**

DRIVER TRAINING

HS-016 669

EXPOSURE AND EXPERIENCE [YOUNG DRIVER AC-  
CIDENTS]

HS-016 665

**Rackoff, N. J.**

A CASE FOR DIAGNOSTIC TESTS IN DRIVER EDU-  
CATION

HS-016 659

**Ramet, M.**

**Rauthmann, A.**

THE FORD AUTOMATIC SAFETY BELT SYSTEM

HS-016 607

**Rayner, C. S.**

ELECTRONIC EQUIPMENT EARNING ITS PLACE ON  
EUROPEAN VEHICLES

HS-016 521

**Riley, M. C.**

SAFE PERFORMANCE CURRICULUM FOR SECONDA-  
RY SCHOOL DRIVER EDUCATION: PROGRAM  
DEVELOPMENT, IMPLEMENTATION, AND TECHNICAL  
FINDINGS. FINAL REPORT

HS-801 491

**Rittmannsberger, R.**

BOSCH ELECTRONIC FUEL INJECTION WITH  
CLOSED LOOP CONTROL

HS-016 532

**Robertson, L. S.**

A CONTROLLED STUDY OF THE EFFECT OF  
TELEVISION MESSAGES ON SAFETY BELT USE

HS-016 723

**Rockwell, T. H.**

A CASE FOR DIAGNOSTIC TESTS IN DRIVER EDU-  
CATION

HS-016 659

EFFECTS OF CARBON MONOXIDE INTOXICATION  
ON DRIVING TASKS

HS-016 652

**Rodger, M.**

OCCUPANT PROTECTION IN FRONTAL IMPACT  
(PASSIVE RESTRAINT), REAR IMPACT AND ROL-  
LOVER

HS-016 568

**Roper, W. L.**

DEADLY DRIVING HABITS. 104 YEAR OLD  
RESOLVES TO QUIT SPEEDING

HS-016 505

DEATH OFTEN RIDES AT THE WHEEL OF THE  
DROWSY DRIVER

HS-016 673

SUICIDAL CRASHER. WATCH OUT FOR THE WRONG  
WAY DRIVER...DEATH MAY BE HIS OBJECTIVE

HS-016 718

**Ross, H. E., Jr.**

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON  
A MOCK VEHICLE EXTERIOR. FINAL REPORT

HS-801 544

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF  
A CRASH VICTIM -- EXTENSION AND VALIDATION  
STUDY. FINAL REPORT

HS-801 547

**Ross, H. L.**

HIGHWAY SAFETY PROGRAMS: HOW DO WE KNOW  
THEY WORK? NORTH CAROLINA SYMPOSIUM ON

- Rosti-Rossini, L.**  
SOME CONSIDERATIONS OF BODY STRUCTURE  
CRUSHABILITY IN RELATION TO IMPACT SPEED  
HS-016 609
- Rullier, J. C.**  
AN OBJECTIVE ANALYSIS OF THE PROTECTION OF-  
FERED BY ACTIVE AND PASSIVE RESTRAINT  
SYSTEMS  
HS-016 693
- Rundkvist, S.**  
STEERABILITY DURING EMERGENCY BRAKING.  
SWEDISH ESV PROJECT  
HS-016 571
- Rupp, W.**  
FRONT ENERGY MANAGEMENT PARAMETRIC  
VARIATION STUDY  
HS-016 600
- Sabey, B. E.**  
ACCIDENT INVESTIGATION AS AN AID TO  
PLANNING THE FUTURE OF CAR SAFETY  
HS-016 583
- Sakai, H.**  
CHARACTERISTICS OF JAPANESE ESV TIRES  
HS-016 636
- Sakai, Y.**  
COMBUSTION CHARACTERISTICS OF THE TORCH  
IGNITED ENGINE  
HS-016 686
- Sakimura, M.**  
REVIEWS ON ACCURACIES AND RESULTS OF ESV  
COLLISION TESTS  
HS-016 622
- Sanderson, J. E.**  
PRIORITY RULES AT UNCONTROLLED INTERSEC-  
TIONS  
HS-016 649
- Sano, S.**  
STEERING AND HANDLING CHARACTERISTICS OF  
A VEHICLE WHEN FAIL-SAFE TIRE IS DEFLATED  
HS-016 637
- Sayre, R. V.**  
RECREATIONAL VEHICLE ACCIDENT INVESTIGA-  
TION STUDY. INTERIM REPORT  
HS-801 523
- Schaefer, H.**  
BAYFLEX: A NEW MATERIAL FOR ELASTOMERIC  
BUMPERS AND BODY PARTS  
HS-016 546
- Schlaß, T. R.**  
APPLICATION OF MICROPROCESSORS TO THE AU-  
TOMOBILE  
HS-016 525
- Schweitzer, P. H.**  
ELECTRONIC OPTIMIZER CONTROL FOR I. C. EN-  
GINE: MOST MPG FOR ANY MPH  
HS-016 534
- Scott, R. E.**  
A SAMPLING PROGRAM FOR EVALUATION OF THE  
1974 RESTRAINT SYSTEMS  
HS-016 699
- Seaton, G. R.**  
TECHNIQUES FOR DRIVING DIGITAL DISPLAYS  
HS-016 531
- Seiffert, U.**  
COMPATIBILITY ON THE ROAD  
HS-016 604
- Seitz, H. G.**  
DRIVER EDUCATION IN CLEVELAND PUBLIC AND  
NON-PUBLIC SCHOOLS AND APPENDICES  
(REFERENCES). UTILIZING PARAPROFESSIONAL  
PERSONNEL AS ROADWORK INSTRUCTORS  
HS-016 509
- Serizawa, Y.**  
A FEASIBILITY STUDY ON SMALL SAFETY VEHI-  
CLES  
HS-016 643
- Sinnamon, J. F.**  
EVALUATION OF SEAT BELT SYSTEM AND DUMMY  
CHARACTERISTICS  
HS-016 598
- Sinnamon, J. F.**  
HYDROPLANING AND TREAD PATTERN  
HYDRODYNAMICS  
HS-016 646
- Sirignano, A.**  
EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 6. ITALY  
HS-016 569
- Smith, G. R.**  
RELATING AIR CUSHION PERFORMANCE TO  
HUMAN FACTORS AND TOLERANCE LEVELS. PT. 3--  
HUMAN VOLUNTEER TESTING  
HS-016 589
- Smith, L. G.**  
SPECIFICATION AND SIMULATION OF  
PYROTECHNIC ENVIRONMENTS  
HS-016 541
- Smith, T. J.**  
TRENDS IN BLOOD ALCOHOL CONCENTRATION  
LEVELS OF NIGHT DRIVERS  
HS-016 654
- Soardo, P.**  
THE STOP LAMP: SOME OPTIMUM VISIBILITY CON-  
SIDERATIONS  
HS-016 631
- Soedel, W.**  
CONTACT OF AN INFLATED TOROIDAL MEMBRANE  
WITH A FLAT SURFACE AS AN APPROACH TO THE  
TIRE DEFLECTION PROBLEM  
HS-016 678
- Spilski, R. A.**  
CLOSED LOOP CARBURETOR EMISSION CONTROL  
SYSTEM  
HS-016 533

- Stahler, N. S.**  
EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS. PT. 1. UNITED STATES (ESV TESTING) HS-016 559
- Stalnaker, R. L.**  
HUMAN TOLERANCE RESEARCH PROGRAM. FIRST YEAR INTERIM REPORT HS-016 506
- Stecherbatcheff, G.**  
PEDESTRIAN PROTECTION HS-016 591
- Steber, W. C.**  
THE EVALUATION OF SAFETY, ENERGY, AND ENVIRONMENTAL FACTORS IN THE AUTOMOTIVE TRANSPORTATION SYSTEM HS-016 638
- Sten, T.**  
YOUNG DRIVERS: THE PROBLEM HS-016 664
- Stephan, J. J.**  
ELECTRONIC DISPLAY SYSTEMS IN THE AUTOMOBILE HS-016 529
- Stocker, A. J.**  
AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF WHEEL SPIN-DOWN AND OTHER VARIABLES. FINAL REPORT HS-016 700
- Stone, K.**  
OCCUPANT PROTECTION DURING VEHICLE ROLLOVER HS-016 619
- Strickland, J.**  
PROD: CARING FOR DRIVERS HS-016 507
- Surace, F.**  
FURTHER RESEARCH ON THE DRIVER/VEHICLE SYSTEM STUDY OF BRAKING IN A TURN HS-016 630
- Suthurst, G. D.**  
OCCUPANT PROTECTION IN FRONTAL IMPACTS: A STATIC, PASSIVE RESTRAINT SYSTEM HS-016 617
- Suzuki, F.**  
THE ECONOMICAL DESIGN OF THE DATSUN PICKUP HS-016 553
- Swart, B.**  
DEREGULATION: THE MOTOR CARRIER DESTRUCTION ACT OF 1975? HS-016 679
- Sweeney, F.**  
WHAT TO DO AFTER THE ACCIDENT
- Swik, R.**  
OPTIMALES ABREMSEN EINES FAHRZEUGES BEI KURVENFAHRT (OPTIMAL VEHICLE BRAKING DURING A TURN) HS-016 5
- Tallqvist, A.**  
PERSONALITY AND OTHER PERSON-CENTRED CHARACTERISTICS HS-016 6
- Tarriere, C.**  
AN OBJECTIVE ANALYSIS OF THE PROTECTION OFFERED BY ACTIVE AND PASSIVE RESTRAINT SYSTEMS HS-016  
PEDESTRIAN PROTECTION HS-016  
SYNTHESIS OF STATISTICAL DATA ON TRAFFIC ACCIDENTS IN FRANCE, WEST GERMANY, ITALY AND UNITED KINGDOM HS-016
- Taylor, H.**  
EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT PROGRAMS, STATUS REPORTS. PT. 2. EUROPEAN EXPERIMENTAL VEHICLES COMMITTEE HS-016
- Temple, M. G.**  
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES. FINAL REPORT HS-80
- Tennant, J. A.**  
GM-ATD 502 ANTHROPOMORPHIC DUMMIES: DEVELOPMENT AND EVALUATION HS-016
- Teper, G. L.**  
DRIVER-VEHICLE CONTROL AND PERFORMANCE IN THE PRESENCE OF AERODYNAMIC DISTURBANCES FROM LARGE VEHICLES HS-0
- Thomson, I. M.**  
DEVELOPMENT AND MANUFACTURE OF AUTOMOBILE BUMPERS HS-0
- Tielking, J. T.**  
HYDROPLANING AND TREAD PATTERN CHARACTERISTICS HS-0
- Tobias, C.**  
EMISSIONS CONTROL OF ENGINE SYSTEMS. SULTANT REPORT HS-
- Trenne, M. U.**  
ELECTRONIC DISPLAY SYSTEMS IN THE AUTOMOBILE HS-
- Tsutsumi, S.**  
VEHICLE CHARACTERISTICS OF THE

- Varde, K. S.**  
THE ROLL OF CONNECTING NOZZLE AND THE  
FLAME INITIATION POINT IN THE PERFORMANCE  
OF A DUAL CHAMBER STRATIFIED CHARGE EN-  
GINE  
HS-016 689
- Ventre, P.**  
AN OBJECTIVE ANALYSIS OF THE PROTECTION OF-  
FERED BY ACTIVE AND PASSIVE RESTRAINT  
SYSTEMS  
HS-016 693  
BASIC RESEARCH VEHICLE-RENAULT BRV  
HS-016 562  
COMPATIBILITY BETWEEN VEHICLES IN FRONTAL  
AND SEMI-FRONTAL COLLISIONS  
HS-016 605
- Voas, R. B.**  
ALCOHOL AND DRUGS  
HS-016 667
- Vogel, S. L.**  
AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 1.  
ENGINEERING MANUAL. FINAL REPORT  
HS-801 507  
AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2.  
MODEL VALIDATION. FINAL REPORT  
HS-801 508  
AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 3.  
USER MANUAL. FINAL REPORT  
HS-801 509  
AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 4.  
PROGRAMMERS MANUAL. FINAL REPORT  
HS-801 510
- Volz, C.**  
ELECTRONIC OPTIMIZER CONTROL FOR I. C. EN-  
GINE: MOST MPG FOR ANY MPH  
HS-016 534
- Voth, R. O.**  
HYDROGEN FUELED AUTOMOBILES  
HS-016 725
- Wagner, F. R.**  
MULTIDISCIPLINARY ACCIDENT INVESTIGATION  
PROGRAM. FINAL REPORT  
HS-801 515  
STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISION. VOL. 1. FINAL REPORT  
HS-801 519  
STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISIONS. VOL. 2. FINAL REPORT  
HS-801 520
- Wagner, M. H.**  
ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL  
COUNTERMEASURES; PHASE 1: HIGH RISK DRIVER  
STUDY PLAN. REPORT  
HS-801 433
- Wall, J. G.**  
HUMAN INJURY TOLERANCE LEVEL DETERMINA-  
TION FROM ACCIDENT DATA USING THE OPAT  
DUMMY  
HS-016 590
- Waller, J. A.**  
PHILOSOPHY, CRITERIA, AND METHODS OF  
DRIVER LICENSING  
HS-016 656
- Waller, P. F.**  
THE CHANGING TASK OF DRIVER LICENSING  
HS-016 661
- Warner, P.**  
THE DEVELOPMENT OF THE OPAT DUMMY  
HS-016 593
- Watson, P.**  
SOME METHODS OF ABSORBING THE ENERGY OF  
MOTOR VEHICLES AND THEIR OCCUPANTS  
HS-016 611
- Wayne, D. A.**  
TECHNIQUES FOR DRIVING DIGITAL DISPLAYS  
HS-016 531
- Weber, R.**  
MEASUREMENT OF TRANSIENT SLIP ANGLES OF  
TIRES-A CONTRIBUTION OF EVALUATING SAFETY-  
RELEVANT DRIVING CONDITIONS  
HS-016 627
- Weir, D. H., R. H. O'Hoh**  
DRIVER-VEHICLE CONTROL AND PERFORMANCE  
IN THE PRESENCE OF AERODYNAMIC  
DISTURBANCES FROM LARGE VEHICLES  
HS-016 651
- Weir, F. W.**  
EFFECTS OF CARBON MONOXIDE INTOXICATION  
ON DRIVING TASKS  
HS-016 652
- Werner, P.**  
BOSCH ELECTRONIC FUEL INJECTION WITH  
CLOSED LOOP CONTROL  
HS-016 532
- White, M. C.**  
VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 4-DROP TESTS OF DUMMIES ON  
A MOCK VEHICLE EXTERIOR. FINAL REPORT  
HS-801 544
- Wiener, E. L.**  
A COMPUTER-BASED SYSTEM FOR LICENSING EL-  
DERLY DRIVERS AND POSSIBLY OTHERS  
HS-016 660
- Wilson, D. G.**  
EMISSIONS CONTROL OF ENGINE SYSTEMS. CON-  
SULTANT REPORT  
HS-016 498
- Wilson, R. A.**  
RELATING AIR CUSHION PERFORMANCE TO  
HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2-

CRASH TESTING THE GENERAL MOTORS AIR  
CUSHION

HS-016 588

**Wineman, A. S.**

THORACIC MODEL IMPROVEMENTS  
(EXPERIMENTAL TISSUE PROPERTIES) VOL. 1 EX-  
ECUTIVE SUMMARY. FINAL REPORT

HS-801 557

THORACIC MODEL IMPROVEMENTS  
(EXPERIMENTAL TISSUE PROPERTIES). VOL. 2.  
TECHNICAL REPORT. FINAL REPORT

HS-801 558

THORACIC MODEL IMPROVEMENTS  
(EXPERIMENTAL TISSUE PROPERTIES). VOLUME 3.  
LITERATURE SURVEY. FINAL REPORT

HS-801 559

**Wixom, C. W.**

A CONTROLLED STUDY OF THE EFFECT OF  
TELEVISION MESSAGES ON SAFETY BELT USE

HS-016 723

**Wooten, R. D.**

PASSENGER CAR AND LIGHT TRUCK SHOCK AB-  
SORBER INSPECTION EQUIPMENT VOL. 1 -- SUMMA-  
RY REPORT. FINAL REPORT

HS-801 527

PASSENGER CAR AND LIGHT TRUCK SHOCK AB-  
SORBER INSPECTION EQUIPMENT. VOL. 2 --  
TECHNICAL REPORT. FINAL REPORT

HS-801 530

**Wulfhorst, D.**

EMISSIONS CONTROL OF ENGINE SYSTEMS. CO  
SULTANT REPORT

HS-016 4

**Yamaguchi, T.**

DIESELIZATION OF LIGHT AND MEDIUM DUT  
COMMERCIAL VEHICLES IN JAPAN

HS-016 5

**Yanase, H.**

PAST AND CONTEMPORARY TRENDS OF COMME  
CIAL VEHICLES IN JAPAN AS VIEWED BY FLE  
OWNER

HS-016 5

**Yang, T. Y.**

CONTACT OF AN INFLATED TOROIDAL MEMBRAN  
WITH A FLAT SURFACE AS AN APPROACH TO TI  
TIRE DEFLECTION PROBLEM

HS-016 4

**Young, R. D.**

VEHICLE EXTERIORS AND PEDESTRIAN INJUR  
PREVENTION. VOL. 4--DROP TESTS OF DUMMIES  
A MOCK VEHICLE EXTERIOR. FINAL REPORT

HS-801

VEHICLE EXTERIORS AND PEDESTRIAN INJUR  
PREVENTION. VOL. 5--A 3-D MATH SIMULATION  
A CRASH VICTIM -- EXTENSION AND VALIDATIO  
STUDY. FINAL REPORT

HS-801

**Zwahlen, H. T.**

A THEORETICAL AND EXPERIMENTAL INVESTIG  
TION OF AUTOMOBILE PATH DEVIATIONS WH  
DRIVER STEERS WITH NO VISUAL INPUT

HS-016

# Corporate Author Index

**Academy of Sciences (U.S.S.R.)**  
FLAME PROPAGATION IN AN EDDY COMBUSTION  
CHAMBER

HS-016 690

**Adam Opel AG**  
OPEL'S SAFETY DEVELOPMENT PROGRESS REPORT

HS-016 564

**Adam Opel AG, West Germany**  
STRUCTURAL AND OCCUPANT PROTECTION  
SYSTEMS OF THE OPEL SAFETY VEHICLE

HS-016 608

**Alfa Romeo, Italy**  
FURTHER RESEARCH ON THE DRIVER/VEHICLE  
SYSTEM STUDY OF BRAKING IN A TURN

HS-016 630

SOME CONSIDERATIONS OF BODY STRUCTURE  
CRUSHABILITY IN RELATION TO IMPACT SPEED

HS-016 609

**Anacapa Sciences Inc., 2034 De La Vina St., Santa  
Barbara, Calif. 93102**

ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL  
COUNTERMEASURES. FINAL REPORT

HS-801 435

**Anonymous Society of Citroen Automobiles**  
[CITROEN EXPERIMENTAL SAFETY VEHICLE PRO-  
GRAM]

HS-016 563

**Association Peugeot-Renault**  
AN OBJECTIVE ANALYSIS OF THE PROTECTION OF-  
FERED BY ACTIVE AND PASSIVE RESTRAINT  
SYSTEMS

HS-016 693

SYNTHESIS OF STATISTICAL DATA ON TRAFFIC  
ACCIDENTS IN FRANCE, WEST GERMANY, ITALY  
AND UNITED KINGDOM

HS-016 580

**Association Peugeot-Renault, Laboratoire de Physiologie  
et de Biomecanique, France**  
PEDESTRIAN PROTECTION

HS-016 591

**Audi NSU Auto-Union AG, West Germany**  
IMPROVING DIRECTIONAL STABILITY UNDER  
BRAKING

HS-016 629

**Auto Restraints Systems, Ltd., England**  
A REVIEW OF DEVELOPMENT OF PASSIVE  
RESTRAINT SYSTEMS

HS-016 596

**Automobile Assoc.**  
THE PUNCTURED PNEUMATIC CAR TIRE FROM THE  
USER'S VIEWPOINT

HS-016 635

**AMF, Inc., Advanced Systems Lab.**  
FRONT ENERGY MANAGEMENT PARAMETRIC  
VARIATION STUDY

HS-016 600

**Barton-Aschman Associates, Inc., 1771 W. Howard St.,  
Chicago, Ill. 60626**

THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE  
AS A MODE OF TRANSPORTATION AND RECREA-  
TION. ATLANTA METROPOLITAN REGION

HS-016 517

THE BICYCLE. A PLAN AND PROGRAM FOR ITS USE  
AS A MODE OF TRANSPORTATION AND RECREA-  
TION. ATLANTA METROPOLITAN REGION. TECHNICAL  
APPENDIX

HS-016 518

**Bayer AG**

BAYFLEX: A NEW MATERIAL FOR ELASTOMERIC  
BUMBERS AND BODY PARTS

HS-016 546

**Bayerische Motoren Werke AG, West Germany**  
RELATIONSHIP BETWEEN VEHICLE FRONT-END  
DEFORMATION AND EFFICIENCY OF SAFETY  
BELTS DURING FRONTAL IMPACT

HS-016 606

**Biomecanic-Accidentology and Crashworthiness Groups  
(C.C.M.C.)**

SYNTHESIS OF STATISTICAL DATA ON TRAFFIC  
ACCIDENTS IN FRANCE, WEST GERMANY, ITALY  
AND UNITED KINGDOM

HS-016 580

**British Leyland Motor Corp., Ltd.**

FACTORS LEADING TO LOSS OF CONTROL--A  
GUIDE FROM ACCIDENT INVESTIGATIONS

HS-016 633

THE APPLICATION OF COMPUTER SIMULATIONS IN  
VEHICLE SAFETY

HS-016 613

VEHICLE COMPATIBILITY IN CAR-TO-CAR SIDE IM-  
PACTS AND PEDESTRIAN-TO-CAR FRONTAL IM-  
PACTS

HS-016 612

**British Leyland Motor Corp., Ltd., Austin Morris  
Vehicle Safety Res. Proj. Section**

[THE SAFETY VEHICLE PROGRAM AT BRITISH LEY-  
LAND MOTOR CORPORATION]

HS-016 567

**British Leyland Motor Corp., Ltd., Safety Test and  
Devel. Dept.**

BRITISH LEYLAND/TRRL EXPERIMENTAL SAFETY  
SYSTEMS CONTRACT

HS-016 566

**California Inst. of Tech.**

THE INFLUENCE OF WIND TUNNEL SOLID BOUN-  
DARIES ON AUTOMOTIVE TEST DATA

HS-016 547

**California Inst. of Technology, Jet Propulsion Lab.**  
A TWO-CHARGE ENGINE CONCEPT: HYDROGEN  
ENRICHMENT

HS-016 688

**Calspan Corp.**

FACTORS INFLUENCING THE PERFORMANCE OF  
THE ENERGY ABSORBING STEERING COLUMN IN  
ACCIDENTS

HS-016 578

THE MECHANICS OF ROLLOVER AS THE RESULT  
OF CURB IMPACT

HS-016 537

THE ROLE OF VEHICLE HANDLING IN ACCIDENT  
CAUSATION

HS-016 692

**Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221**

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 1.  
ENGINEERING MANUAL. FINAL REPORT

HS-801 507

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 2.  
MODEL VALIDATION. FINAL REPORT

HS-801 508

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 3.  
USER MANUAL. FINAL REPORT

HS-801 509

AN IMPROVED THREE DIMENSIONAL COMPUTER  
SIMULATION OF VEHICLE CRASH VICTIMS. VOL. 4.  
PROGRAMMERS MANUAL. FINAL REPORT

HS-801 510

**Carnegie-Mellon Univ., Mechanical Engineering Dept.,  
Pittsburg, Pa. 15213**

THEORETICAL STUDY OF NONLINEAR MEMBRANE  
PROBLEMS WITH APPLICATIONS TO AIR BAGS.  
FINAL REPORT

HS-801 540

**Caterpillar Tractor Co.**

BRAKESAEVER -- CATERPILLAR'S HIGHWAY TRUCK  
RETARDER

HS-016 554

**Center for the Environment and Man, Inc.**

EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE,  
CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR  
CRASHES

HS-016 577

**Chevrolet Engineering Center, Warren, Mich.**

CLOSED LOOP CARBURETOR EMISSION CONTROL  
SYSTEM

HS-016 533

**Circuitry, The Lucas Electrical Co. Ltd., Shirley, West  
Midlands, England**

ELECTRONIC EQUIPMENT EARNING ITS PLACE ON  
EUROPEAN VEHICLES

HS-016 521

**Cleveland Public Schools, Driver Education Div., 1380****E. 6th St., Cleveland, Ohio 44114**

DRIVER EDUCATION IN CLEVELAND PUBLIC AND  
NON-PUBLIC SCHOOLS AND APPENDICES

**Columbia Univ., School of Engineering and Applied  
Science, New York City**

CRITICAL ASSESSMENT OF SOCIAL AND  
ECONOMIC IMPLICATIONS OF SAFETY CARS

HS-016 556

**Daimler-Benz AG, West Germany**

THE RELATION BETWEEN VEHICLE HANDLING  
AND ACCIDENT AVOIDANCE

HS-016 626

**David Ogle Ltd., England**

THE DEVELOPMENT OF THE OPAT DUMMY

HS-016 593

**Department of Motor Cars**

FIAT TECHNICAL PRESENTATION

HS-016 570

**Department of Transportation**

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. SAFETY IMPLICATIONS  
PANEL REPORT NO. 2

HS-016 500

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. TRUCK AND BUS  
PANEL REPORT NO. 7

HS-016 501

**Department of Transportation, Systems Devel. and  
Technology**

THE EVALUATION OF SAFETY, ENERGY, AND EN-  
VIRONMENTAL FACTORS IN THE AUTOMOTIVE  
TRANSPORTATION SYSTEM

HS-016 638

**Dionics Inc., Westbury, N. Y.**

TECHNIQUES FOR DRIVING DIGITAL DISPLAYS

HS-016 531

**Dunlop Ltd., Advanced Products Group, England**

THE DUNLOP MK 2 COMPOSITE ENERGY ABSORB-  
ING BUMPER SYSTEM

HS-016 615

**Dunlop Ltd., Tire Technical Div., England**

SAFETY ASPECTS OF DENOVO RUN FLAT TIRES

HS-016 632

**DRIVER v8 n12 p1-7 (May 1975)**

EVERYTHING YOU NEED TO KNOW ABOUT TIRES

HS-016 719

**DRIVER v8 n12 p14-7 (May 1975)**

TAKE YOUR MOTORCYCLE ALONG

HS-016 715

**E. I. duPont de Nemours and Co., Elastomer Chemicals  
Dept.**

FLEXIBLE EXTERIOR AUTOMOTIVE TRIM

HS-016 603

**Eaton Corp., Climate Control Div.**

CAB CONDITION -- HEATING AND COOLING--  
HEAVY DUTY TRUCK AND OFF-HIGHWAY EQUIP-  
MENT



**Eaton Corp., Safety Systems Div., Troy, Mich.**  
ELECTRONIC FAULT MONITORING AND DIAGNOSIS  
IN AIR BAG SYSTEMS

HS-016 535

**Economics and Science Planning, Inc. 1200 18th St.,  
N.W., Washington, D.C. 20036**

RECOMMENDED U.S. AUTOMOTIVE EMISSION  
STANDARDS

HS-016 711

**Edward Hine Jr., VA Hospital, Hines, Ill.**

PERSONALITY AND TEMPERAMENT DIFFERENCES  
BETWEEN ALCOHOLICS WITH HIGH AND LOW  
RECORDS OF TRAFFIC ACCIDENTS AND VIOLA-  
TIONS

HS-016 696

**Enersorb Ltd., England**

DEVELOPMENT AND MANUFACTURE OF AUTOMO-  
BILE BUMPERS

HS-016 621

**Environmental Protection Agency**

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. SAFETY IMPLICATIONS  
PANEL REPORT NO. 2

HS-016 500

STUDY OF POTENTIAL FOR MOTOR VEHICLE FUEL  
ECONOMY IMPROVEMENT. TRUCK AND BUS  
PANEL REPORT NO. 7

HS-016 501

**Environmental Protection Agency, Alternative  
Automotive Power Systems Div.**

AN OVERVIEW OF THE U.S. GOVERNMENT PRO-  
GRAM TO EVALUATE ALTERNATIVE POWER-  
PLANTS TO THE CONVENTIONAL INTERNAL COM-  
BUSTION ENGINES FOR AUTOMOBILES

HS-016 639

**Environmental Protection Agency, Office of Mobile  
Source Air Pollution Control**

EMISSIONS CONTROL OF ENGINE SYSTEMS. CON-  
SULTANT REPORT

HS-016 498

MANUFACTURABILITY AND COSTS OF PROPOSED  
LOW-EMISSIONS AUTOMOTIVE ENGINE SYSTEMS.  
CONSULTANT REPORT

HS-016 502

**Environmental Protection Agency, 4th and M St., S.W.,  
Washington, D.C. 20460**

PROGRESS IN THE IMPLEMENTATION OF MOTOR  
VEHICLE EMISSION STANDARDS THROUGH JUNE  
1974. REPORT TO CONGRESS

HS-016 702

**European Experimental Vehicles Com.**

EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 2. EUROPEAN  
EXPERIMENTAL VEHICLES COMMITTEE

HS-016 560

THE FUTURE FOR CAR SAFETY IN EUROPE. A RE-  
PORT OF THE EEVC

HS-016 561

**Federal Hwy. Administration, Office of Traffic  
Operations**

POSITIVE GUIDANCE IN TRAFFIC CONTROL

HS-016 698

**Federal Transport Ministry, Bundesminister Fur  
Verkehr (BMV) Bonn, Germany**

FOR MORE SAFETY ON OUR ROADS. THE ROAD  
SAFETY PROGRAMME (PROGRAM) OF THE  
FEDERAL REPUBLIC OF GERMANY. "PEOPLE HAVE  
THE RIGHT OF WAY"

HS-016 539

**Ford Motor Co.**

RESEARCH SAFETY VEHICLE CRASH EFFECTIVE-  
NESS METHODOLOGY

HS-016 640

**Ford Motor Co., Advanced Vehicles Engineering,  
Dearborn, Mich.**

FUNDAMENTALS OF AUTOMOTIVE ELECTRICAL  
DISTRIBUTION

HS-016 536

**Ford Motor Co., Body Advanced Engineering**

THE FORD AUTOMATIC SAFETY BELT SYSTEM

HS-016 607

**Ford Motor Co., Dearborn, Mich. 48121**

EFFECTS OF TIRE ROLLING RESISTANCE ON VEHI-  
CLE FUEL CONSUMPTION

HS-016 675

**Ford Motor Co., Instrument Panel Package and Design,  
Dearborn, Mich.**

ELECTRONIC DISPLAY APPLICATIONS IN INSTRU-  
MENT PANEL DESIGN

HS-016 530

**Ford Motor Co., Ltd., England**

OCCUPANT PROTECTION DURING VEHICLE ROL-  
LOVER

HS-016 619

OCCUPANT PROTECTION IN FRONTAL IMPACTS: A  
STATIC, PASSIVE RESTRAINT SYSTEM

HS-016 617

OCCUPANT PROTECTION IN REAR IMPACT

HS-016 618

**Ford Motor Co., Ltd., Res. and Engineering Center**

OCCUPANT PROTECTION IN FRONTAL IMPACT  
(PASSIVE RESTRAINT), REAR IMPACT AND ROL-  
LOVER

HS-016 568

**Ford Motor Co., Systems Res. Lab., Dearborn, Mich.**

DESIGN CONSIDERATIONS FOR AN ON-BOARD  
COMPUTER SYSTEM

HS-016 527

ENGINE CONTROL BY AN ON-BOARD COMPUTER

HS-016 526

**FMC Corp., Chain Div.**

MEASUREMENT OF AUTOMOTIVE TIMING CHAIN  
DRIVE LOADS

HS-016 548

**General Motors Corp.**  
EFFECTS OF CARBON MONOXIDE INTOXICATION  
ON DRIVING TASKS

HS-016 652

PROGRESS IN AUTOMOTIVE ELECTRONICS

HS-016 520

THE INFLUENCE OF WIND TUNNEL SOLID BOUN-  
DARIES ON AUTOMOTIVE TEST DATA

HS-016 547

VOLUME AND TEMPERATURE INFLUENCES ON  
THE EFFECTIVENESS OF LEAN THERMAL REAC-  
TORS

HS-016 687

**General Motors Corp., Environmental Activities Staff**  
RELATING AIR CUSHION PERFORMANCE TO  
HUMAN FACTORS AND TOLERANCE LEVELS. PT. 1-  
PROGRAM DEVELOPMENT

HS-016 587

RELATING AIR CUSHION PERFORMANCE TO  
HUMAN FACTORS AND TOLERANCE LEVELS. PT. 2--  
CRASH TESTING THE GENERAL MOTORS AIR  
CUSHION

HS-016 588

RELATING AIR CUSHION PERFORMANCE TO  
HUMAN FACTORS AND TOLERANCE LEVELS. PT. 3--  
HUMAN VOLUNTEER TESTING

HS-016 589

**General Motors Corp., General Motors Technical  
Center, Warren, Mich.**  
ELECTRONIC DISPLAY SYSTEMS IN THE AUTOMO-  
BILE

HS-016 529

**General Motors Corp., Safety R & D Lab., Warren,  
Mich. 48090**  
TRAFFIC FATALITIES AND THE ENERGY CRISIS: A  
SECOND FOUR MONTH ANALYSIS MAY - AUG 1974

HS-016 732

**General Motors Corp., Saginaw Steering Gear Div.**  
A LABORATORY FATIGUE TEST PROGRAM FOR  
STEERING COMPONENTS BASED ON FIELD LOAD  
DATA

HS-016 542

**General Motors Corp., Warren, Mich.**  
APPLICATION OF MICROPROCESSORS TO THE AU-  
TOMOBILE

HS-016 525

**General Motors Engineering Staff, Advance Product  
Engineering**  
GM-ATD 502 ANTHROPOMORPHIC DUMMY--  
DEVELOPMENT AND EVALUATION

HS-016 586

**General Motors Overseas Operations**  
DESIGN AND OPERATION OF EUROPEAN TRUCKS  
FOR MAXIMUM FUEL ECONOMY

HS-016 691

**General Motors Res. Lab., Warren, Mich.**  
CLOSED LOOP CARBURETOR EMISSION CONTROL  
SYSTEM

HS-016 533

**General Motors Res. Labs.**  
THE PHYSICS OF TIRE TRACTION. THEORY AND  
EXPERIMENT

HS-016 516

**German Assoc. of Liability, Accident and Motor Traffic  
Insurer--(HUK-Verband)**  
THE FREQUENCY OF CORRESPONDING VEHICLE  
DAMAGE IN CRASH TESTS AND ACTUAL AC-  
CIDENTS

HS-016 582

**Gruen Associates, Los Angeles, Calif.**  
TRAFFIC CIRCULATION PLANNING FOR COMMUNI-  
TIES

HS-016 712

**Highway Users Federation for Safety and Mobility**  
DRIVER LICENSING LAW: HELP OR HINDRANCE?

HS-016 657

**Honda Motor Co., Ltd.**  
STEERING AND HANDLING CHARACTERISTICS OF  
A VEHICLE WHEN FAIL-SAFE TIRE IS DEFLATED

HS-016 637

**Honda Motor Co., Ltd., Japan**  
CHARACTERISTICS OF BODY ENERGY ABSORPTION  
AND RESTRAINT SYSTEM

HS-016 623

**Hughes Aircraft Co.**  
SPECIFICATION AND SIMULATION OF  
PYROTECHNIC ENVIRONMENTS

HS-016 541

**Human Resources Res. Organization 300 N. Washington  
St., Alexandria, Va. 22314**  
SAFE PERFORMANCE CURRICULUM FOR SECONDA-  
RY SCHOOL DRIVER EDUCATION: PROGRAM  
DEVELOPMENT, IMPLEMENTATION, AND TECHNI-  
CAL FINDINGS. FINAL REPORT

HS-801 491

**Imperial Metal Industries Ltd., Kynoch Works, Witton,  
England**  
THE ROLE OF EXTRUSION DEVICES IN ENERGY  
ABSORPTION FOR SAFETY

HS-016 614

**Industrie Pirelli S.p.A., Milan, Italy**  
EVALUATION OF TIRE ABRASION IN TERMS OF  
DRIVING SEVERITY

HS-016 706

**Institute for Road Safety Research SWOV. Crash and  
Post-crash Dept., Voorburg**  
LAP BELTS AND 3-POINT BELTS: A COMPARISON  
OF EFFECTIVENESS

HS-016 681

**Istituto Elettrotecnico Nazionale Galileo Fennanis  
(IEN), Italy**  
THE STOP LAMP: SOME OPTIMUM VISIBILITY CON-  
SIDERATIONS

HS-016 631

**Insurance Inst. for Hwy. Safety, Detroit, Mich. 48918**  
EMPIRICAL RELATIONSHIPS BETWEEN CAR SIZE,  
CAR WEIGHT AND CRASH INJURIES IN CAR-TO-CAR  
CRASHES

HS-016 577

**RSV, CRASH HAZARDS AND PUBLIC SUPPORT**  
HS-016 599

**Insurance Inst. for Hwy. Safety, Washington, D.C. 20037**  
A CONTROLLED STUDY OF THE EFFECT OF  
TELEVISION MESSAGES ON SAFETY BELT USE  
HS-016 723

**International Quantum Science Corp., Palo Alto, Calif.**  
ELECTRONIC EQUIPMENT USAGE ON JAPANESE  
VEHICLES  
HS-016 522

**Isuzu Motors Ltd., Japan**  
DIESELIZATION OF LIGHT AND MEDIUM DUTY  
COMMERCIAL VEHICLES IN JAPAN  
HS-016 552

**Japan Automobile Res. Inst., Inc. (J.A.R.I.)**  
REVIEWS ON ACCURACIES AND RESULTS OF ESV  
COLLISION TESTS  
HS-016 622

**Japan Automobile Res. Inst., Inc. (JARI)**  
CHARACTERISTICS OF JAPANESE ESV TIRES  
HS-016 636

THE TEST OF JAPANESE EXPERIMENTAL VEHICLES  
(GENERAL DESCRIPTION)  
HS-016 572

THE TEST OF JAPANESE EXPERIMENTAL VEHICLES  
(SUMMARY OF TOYOTA ESV TEST)  
HS-016 573

THE TEST OF JAPANESE EXPERIMENTAL VEHICLES  
(SUMMARY OF NISSAN ESV TEST)  
HS-016 574

**Kennametal, Inc., Latrobe, Pa. 15650**  
THE CASE FOR SAFETY WITH STUDDED TIRES  
HS-016 704  
THE CASE FOR SAFETY WITH STUDDED TIRES. PT.  
2. SUPPORT DATA  
HS-016 705

**Ketron Inc., 530 E. Swedesford Rd., Wayne, Pa. 19087**  
ANALYSIS OF HIGH RISK DRIVERS FOR ALCOHOL  
COUNTERMEASURES. FINAL REPORT  
HS-801 436

**Lehrstuhl für Angewandte Thermodynamik an der  
Rheinisch-Westfälischen Technischen Hochschule Aachen**  
SINGLE-CYLINDER STUDY OF STRATIFIED CHARGE  
PROCESS WITH PRECHAMBER-INJECTION  
HS-016 685

**Loyola Univ. of Chicago.**  
PERSONALITY AND TEMPERAMENT DIFFERENCES  
BETWEEN ALCOHOLICS WITH HIGH AND LOW  
RECORDS OF TRAFFIC ACCIDENTS AND VIOLATIONS  
HS-016 696

**Mainlin Transport Corp.**  
WHAT TO DO AFTER THE ACCIDENT  
HS-016 722

**Michigan Dept. of State, Lansing, Mich. 48918**  
MICHIGAN DRIVER STATISTICS. REPORT NO. 7.  
JUNE 25, 1974  
HS-016 716

**Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017**  
DEVELOPMENT OF AN ADVANCED PASSIVE  
RESTRAINT SYSTEM FOR SUBCOMPACT CAR  
DRIVERS. FINAL REPORT  
HS-801 528

**Ministry of Transport and Civil Aviation, Italy**  
EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 6. ITALY  
HS-016 569

**Ministry of Transport, Road Transport Div., Wellington, N.Z.**  
PRIORITY RULES AT UNCONTROLLED INTERSECTIONS  
HS-016 649

**Molycorp, Inc.**  
PRESENT STATUS OF COLD-ROLLED HIGH  
STRENGTH STEEL DEVELOPMENT  
HS-016 544

**Motor Industry Res. Assoc.**  
PERFORMANCE MEASUREMENTS ON THE OPAT  
DUMMY  
HS-016 594

**National Com. on Uniform Traffic Laws and Ordinances,  
1776 Mass. Ave., N.W., Washington, D.C. 20036**  
AGENDA FOR NATIONAL COMMITTEE MEETING  
(ON UNIFORM TRAFFIC LAWS AND ORDINANCES)  
HS-016 695

**National Hwy. Traffic Safety Administration**  
OVERVIEW OF NHTSA RESEARCH ACTIVITIES IN  
DRIVER EDUCATION AND LICENSING  
HS-016 658

**National Hwy. Traffic Safety Administration, Office of  
Accident Investigation and Data Analysis, 400, 7th St.,  
S.W., Washington, D.C. 20590**  
MULTIDISCIPLINARY ACCIDENT INVESTIGATION  
SUMMARIES VOL. 5, NO. 3  
HS-601 817

**National Hwy. Traffic Safety Administration, Office of  
Accident Investigation and Data Analysis, 400 7th St.,  
S.W., Washington, D. C. 20590**  
MULTIDISCIPLINARY ACCIDENT INVESTIGATION  
SUMMARIES VOL. 6, NO. 9  
HS-801 496

**National Hwy. Traffic Safety Administration, Office of  
Accident Investigation and Data Analysis, 400 7th St.,  
S.W., Washington, D.C. 20590**  
MULTIDISCIPLINARY ACCIDENT INVESTIGATION  
SUMMARIES VOL. 6, NO. 7  
HS-801 497

**National Hwy. Traffic Safety Administration, Office of  
Accident Investigation and Data Analysis, 400 Seventh  
St., S.W., Washington, D.C. 20590**  
MULTIDISCIPLINARY ACCIDENT INVESTIGATION  
SUMMARIES VOL. 6, NO. 3  
HS-801 500

**Texas A and M Univ., Texas Transportation Inst.,  
College Station, Tex. 77843**

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 2 -- ANALYSIS OF ACCIDENT IN-  
FORMATION. FINAL REPORT

HS-801 542

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 4--DROP TESTS OF DUMMIES ON A  
MOCK VEHICLE EXTERIOR. FINAL REPORT

HS-801 544

VEHICLE EXTERIORS AND PEDESTRIAN INJURY  
PREVENTION. VOL. 5--A 3-D MATH SIMULATION OF  
A CRASH VICTIM -- EXTENSION AND VALIDATION  
STUDY. FINAL REPORT

HS-801 547

**Texas A and M University, Texas Transportation Inst.,  
College Station, Texas 77843**

AUTOMOBILE TIRE HYDROPLANING -- A STUDY OF  
WHEEL SPIN-DOWN AND OTHER VARIABLES.  
FINAL REPORT

HS-016 700

**Texas Instruments, Inc.**

DESIGN SOLUTIONS FOR TEMPERATURE SENSING  
IN DIFFICULT AUTOMOTIVE APPLICATIONS

HS-016 550

**The Committee on Injuries, American Acad. of  
Orthopaedic Surgeons, Chicago, Ill. 60611**

EMERGENCY CARE AND TRANSPORTATION OF THE  
SICK AND INJURED

HS-016 713

**The Goodyear Tire and Rubber Co., Akron, Ohio 44316**

A MODEL ANALYSIS OF THE STRUCTURAL AND  
PNEUMATIC CONTRIBUTIONS TO TIRE BEHAVIOR  
UNDER VERTICAL LOADS

HS-016 677

**The Ohio State Univ.**

EFFECTS OF CARBON MONOXIDE INTOXICATION  
ON DRIVING TASKS

HS-016 652

**The Urban Inst., 2100 M St., N.W., Washington, D. C.  
20037**

GUIDELINES ON THE OPERATION OF SUBSCRIP-  
TION BUS SERVICES

HS-016 538

**Toyota Motor Co., Ltd., Body Engineering Design Dept.,  
Japan**

COST-BENEFIT ANALYSIS OF BUMPER SYSTEMS  
FOR SMALL CARS

HS-016 644

**Tracor Jitco, Inc.**

FEASIBILITY STUDY OF IN-VEHICLE WARNING  
SYSTEMS. FINAL REPORT

HS-801 569

**Tracor Jitco, Inc., 1776 E. Jefferson St., Rockville, Md.  
20852**

PASSENGER CAR AND LIGHT TRUCK SHOCK AB-  
SORBER INSPECTION EQUIPMENT VOL. 1 -- SUMMA-  
RY REPORT. FINAL REPORT

HS-801 527

PASSENGER CAR AND LIGHT TRUCK SHOCK AB-  
SORBER INSPECTION EQUIPMENT. VOL. 2 --  
TECHNICAL REPORT. FINAL REPORT

HS-801 530

**Transport and Road Res. Lab.  
DRIVERS' LIMITATIONS**

HS-016 634

**Transport and Road Res. Lab., Dept. of the Environment  
EXPERIMENTAL SAFETY VEHICLE DEVELOPMENT  
PROGRAMS, STATUS REPORTS. PT. 2. EUROPEAN  
EXPERIMENTAL VEHICLES COMMITTEE**

HS-016 560

**Transport and Road Res. Lab., Dept. of the  
Environment, England**

SOME PATTERNS AND CAUSES OF INJURY IN CAR  
OCCUPANTS

HS-016 584

TOWARDS PEDESTRIAN SAFETY

HS-016 595

**Transport and Road Res. Lab., England**

ACCIDENT INVESTIGATION AS AN AID TO  
PLANNING THE FUTURE OF CAR SAFETY

HS-016 583

HUMAN INJURY TOLERANCE LEVEL DETERMINA-  
TION FROM ACCIDENT DATA USING THE OPAT  
DUMMY

HS-016 590

SOME METHODS OF ABSORBING THE ENERGY OF  
MOTOR VEHICLES AND THEIR OCCUPANTS

HS-016 611

**Transport and Road Research Laboratory, Safety Dept.,  
Crowthorne, Berks, 1975 (England)**

THE HAMPSHIRE CHILD PEDESTRIAN ACCIDENT  
STUDY

HS-016 674

**Transportation Res. Board, National Res. Council  
FUTURE ROLE OF DRIVER LICENSING IN  
HIGHWAY SAFETY**

HS-016 655

**Transportation Res. Board, National Res. Council,  
Washington, D.C.**

DRIVER PERFORMANCE. TRANSPORTATION  
RESEARCH RECORD 520

HS-016 650

**Triplex Safety Glass Co., Ltd., England**

REDUCED LACERATION FROM A NEW LAMINATED  
WINDSHIELD

HS-016 597

**Ultrasystems, Inc.**

ANALYSIS OF TEST RESULTS FOR AMF/FIAT ESV  
HEAD-ON COLLISION

HS-016 601

**Ultrasystems, Inc., The Dynamic Science Div., 1850 West  
Pinnacle Peak Rd., Phoenix, Ariz. 85027**

DEVELOPMENT OF A SCHOOL BUS FUEL SYSTEM  
INTEGRITY COMPLIANCE PROCEDURE. FINAL RE-  
PORT

HS-801 529

- MODELS USING THE ROAD SIMULATOR  
HS-016 543
- University of California, Los Angeles, Calif.**  
NONLINEAR WAVE PROPAGATION IN  
VISCOELASTIC TUBES: APPLICATION TO AORTIC  
RUPTURE  
HS-016 676
- University of Chicago, Graduate School of Business, 5836  
Greenwood Ave., Chicago, Ill. 60637**  
THE EFFECTS OF AUTOMOBILE SAFETY REGULA-  
TION  
HS-016 511
- University of Denver**  
HIGHWAY SAFETY PROGRAMS: HOW DO WE KNOW  
THEY WORK? NORTH CAROLINA SYMPOSIUM ON  
HIGHWAY SAFETY, RALEIGH, SPRING, 1974. VOL. 10  
HS-016 648
- University of Kentucky Multidisciplinary Accident Study  
Team, Dept. of Civil Engineering, Lexington, Ky. 40506**  
RECREATIONAL VEHICLE ACCIDENT INVESTIGA-  
TION STUDY. INTERIM REPORT  
HS-801 523
- University of Miami**  
A COMPUTER-BASED SYSTEM FOR LICENSING EL-  
DERLY DRIVERS AND POSSIBLY OTHERS  
HS-016 660
- University of Michigan, Hwy. Safety Res. Inst.**  
A PROPOSED NEW NATIONAL SYSTEM FOR COL-  
LECTING MULTIPURPOSE ACCIDENT DATA: SIR  
HS-016 576  
HYDROPLANING AND TREAD PATTERN  
HYDRODYNAMICS  
HS-016 646
- University of Michigan, Hwy. Safety Res. Inst., Ann  
Arbor, Mich. 48105**  
DEVELOPMENT OF A COMPUTER SIMULATION TO  
PREDICT THE VISIBILITY DISTANCE PROVIDED BY  
HEADLAMP BEAMS  
HS-016 647  
THORACIC MODEL IMPROVEMENTS  
(EXPERIMENTAL TISSUE PROPERTIES) VOL. 1 EX-  
ECUTIVE SUMMARY. FINAL REPORT  
HS-801 557  
THORACIC MODEL IMPROVEMENTS  
(EXPERIMENTAL TISSUE PROPERTIES) VOL. 2.  
TECHNICAL REPORT. FINAL REPORT  
HS-801 558
- University of Michigan, Hwy. Safety Res. Inst., Huron  
Parkway & Baxter Road, Ann Arbor, Mich. 48105**  
A SAMPLING PROGRAM FOR EVALUATION OF THE  
1974 RESTRAINT SYSTEMS  
HS-016 699
- University of Michigan, Hwy. Safety Res. Inst., Huron  
Pkwy. and Baxter Rd., Ann Arbor, Mich. 48105**  
HUMAN TOLERANCE RESEARCH PROGRAM. FIRST  
YEAR INTERIM REPORT  
HS-016 506
- ANALYSIS OF HIGH RISK GROUPS FOR ALCOHOL  
COUNTERMEASURES. FINAL REPORT ON PHASE 1**  
HS-801 434
- University of Michigan, Hwy. Safety Res. Inst., Huron  
Pkwy. and Baxter Rd., Ann Arbor, Mich. 48105**  
THORACIC MODEL IMPROVEMENTS  
(EXPERIMENTAL TISSUE PROPERTIES). VOLUME 3.  
LITERATURE SURVEY. FINAL REPORT  
HS-801 559
- University of North Carolina, Hwy. Res. Center**  
HIGHWAY SAFETY PROGRAM EVALUATION AND  
RESEARCH  
HS-016 724
- University of North Carolina, Hwy. Safety Res. Center**  
THE CHANGING TASK OF DRIVER LICENSING  
HS-016 661
- University of Nottingham, Wolfson Inst. of Interfacial  
Technology, England**  
ENERGY ABSORPTION BY VARIABLE SHEAR  
STRENGTH DUPLEX MATERIALS  
HS-016 616
- University of Rochester, Dept. of Mechanical and  
Aerospace Sciences**  
THE ROLL OF CONNECTING NOZZLE AND THE  
FLAME INITIATION POINT IN THE PERFORMANCE  
OF A DUAL CHAMBER STRATIFIED CHARGE EN-  
GINE  
HS-016 689
- University of Utah, Salt Lake City, Utah 84112**  
MULTIDISCIPLINARY ACCIDENT INVESTIGATION  
PROGRAM. FINAL REPORT  
HS-801 515
- University of Utah, Utah Auto Crash Res. Team, Salt  
Lake City, Utah 84112**  
STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISION. VOL. 1. FINAL REPORT  
HS-801 519
- University of Utah, Utah Auto Res. Team, Salt Lake  
City, Utah 84112**  
STUDY OF POST-CRASH FACTORS IN AUTOMOBILE  
COLLISIONS. VOL. 2. FINAL REPORT  
HS-801 520
- University of Vermont, Dept. of Community Medicine**  
PHILOSOPHY, CRITERIA, AND METHODS OF  
DRIVER LICENSING  
HS-016 656
- Virginia Hwy. and Transportation Res. Council**  
TRENDS IN BLOOD ALCOHOL CONCENTRATION  
LEVELS OF NIGHT DRIVERS  
HS-016 654
- Volkswagenwerk AG, Res. and Devel. Center**  
THE ESVW 2, VOLKSWAGEN'S EXPERIMENTAL  
SAFETY VEHICLE  
HS-016 565

**Volkswagenwerke AG, Res. and Devel. Center, West  
Germany**

COMPATIBILITY ON THE ROAD

HS-016 604

**Volkswagenwerke AG, West Germany**

BENEFIT/COST ANALYSIS AS A BASIS FOR DECISIONS IN THE AUTOMOTIVE INDUSTRY

HS-016 641

**Western Gillette, Inc.**

A CASE FOR STANDARDIZATION [TRUCK WIRING]

HS-016 684

**Whitaker Cable Corp**

A CASE FOR STANDARDIZATION [TRUCK WIRING]

HS-016 684

**1776 E. Jefferson St., Rockville, Md. 20852**

FEASIBILITY STUDY OF IN-VEHICLE WARNING  
SYSTEMS. FINAL REPORT

HS-801 569

## Contract Number Index

### DOT-HS-003-2-427

Human Resources Res. Organization 300 N. Washington St.,  
Alexandria, Va. 22314

HS-801 491

### DOT-HS-031-3-763

University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,  
Mich. 48105

HS-801 557

University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,  
Mich. 48105

HS-801 558

University of Michigan, Hwy. Safety Res. Inst., Huron  
Pkwy. and Baxter Rd., Ann Arbor, Mich. 48105

HS-801 559

### DOT-HS-047-1-063

University of Utah, Salt Lake City, Utah 84112

HS-801 515

University of Utah, Utah Auto Crash Res. Team, Salt Lake  
City, Utah 84112

HS-801 519

University of Utah, Utah Auto Res. Team, Salt Lake City,  
Utah 84112

HS-801 520

### DOT-HS-053-2-485

Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221

HS-801 507

Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221

HS-801 508

Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221

HS-801 509

Calspan Corp., 4455 Genesee St., Buffalo, N.Y. 14221

HS-801 510

### DOT-HS-065-1-217

Texas A and M Univ., Texas Transportation Inst., College  
Station, Tex. 77843

HS-801 542

Texas A and M Univ., Texas Transportation Inst., College  
Station, Tex. 77843

HS-801 544

Texas A and M Univ., Texas Transportation Inst., College  
Station, Tex. 77843

HS-801 547

### DOT-HS-113-3-742

Minicars, Inc., 35 La Patera Lane, Goleta, Calif. 93017

HS-801 528

### DOT-HS-201-3-766

University of Kentucky Multidisciplinary Accident Study  
Team, Dept. of Civil Engineering, Lexington, Ky. 40506

HS-801 523

### DOT-HS-256-3-752

Tracor Jitco, Inc.; 1776 E. Jefferson St., Rockville, Md.  
20852

HS-801 569

### DOT-HS-256-3-755

Tracor Jitco, Inc., 1776 E. Jefferson St., Rockville, Md.  
20852

HS-801 527

Tracor Jitco, Inc., 1776 E. Jefferson St., Rockville, Md.  
20852

HS-801 530

### DOT-HS-263-2-470

Carnegie-Mellon Univ., Mechanical Engineering Dept., Pitt-  
sburg, Pa. 15213

HS-801 540

### DOT-HS-345-3-691

Olin Corp., Energy Systems Operation, Marion, Ill. 62959

HS-801 590

Olin Corp., Energy Systems Operation, Marion, Ill. 62959

HS-801 591

### DOT-HS-4-00872

Ultrasystems, Inc., The Dynamic Science Div., 1850 West  
Pinnacle Peak Rd., Phoenix, Ariz. 85027

HS-801 529

### DOT-HS-4-00989

Technical Res. Associates, Inc. 10604 Warwick Ave., Fair-  
fax, Va. 22030

HS-801 433

### DOT-HS-4-00990

University of Michigan, Hwy. Safety Res. Inst., Huron  
Pkwy and Baxter Rd., Ann Arbor, Mich. 48105

HS-801 434

### DOT-HS-4-00991

Anacapa Sciences Inc., 2034 De La Vina St., Santa Barbara,  
Calif. 93102

HS-801 435

### DOT-HS-4-00992

Ketron Inc., 530 E. Swedesford Rd., Wayne, Pa. 19087

HS-801 436

### DOT-UT-40008

The Urban Inst., 2100 M St., N.W., Washington, D. C.  
20037

HS-016 538

### FH-11-7537

Technical Education Res. Centers, Inc. Midwest Center,  
Champaign, Ill. 61820

HS-801 517

### UM7204-C128

University of Michigan, Hwy. Safety Res. Inst., Ann Arbor,  
Mich. 48105

HS-016 647





A-3216	SAE-741077	HS-016 550
EPA 230/3-74-013	SAE-741125	HS-016 551
HumRRO-TR-74-23	SAE-741126	HS-016 552
IEEE-75CH0976-1VT	SAE-741127	HS-016 553
NBS-SP-419	SAE-741128	HS-016 691
PB-237076/AS	SAE-741129	HS-016 554
PR-15	SAE-741130	HS-016 555
PR-16	SAE-741131	HS-016 683
R-2	SAE-741143	HS-016 684
R-52	SAE-741161	HS-016 689
R-7	SAE-741162	HS-016 685
RF-814-1-Vol-2	SAE-741165	HS-016 690
RF-814-1-Vol-4	SAE-741167	HS-016 686
RF-814-1-Vol-5	SAE-741168	HS-016 687
SAE-SP-393	SAE-741169	HS-016 688
SAE-740805	SAE-750115	HS-016 692
SAE-740944	SAE-750199	HS-016 520
SAE-740945	SAE-750200	HS-016 521
SAE-740958	SAE-750201	HS-016 522
SAE-740978	SAE-750202	HS-016 523
SAE-741023	SAE-750364	HS-016 528
SAE-741031	SAE-750365	HS-016 529
SAE-741046	SAE-750366	HS-016 530
SAE-741075	SAE-750367	HS-016 531

HSL 75-1

SAE-750368		TRR-6	
	HS-016 532		HS-016 64
SAE-750370		TRRL-LR-668	
	HS-016 534		HS-016 67
SAE-750371		TTI-2-10-70-147-3F	
	HS-016 533		HS-016 70
SAE-750393		UI-2310-75-90	
	HS-016 693		HS-801 52
SAE-750400		UI-5021-4	
	HS-016 694		HS-016 53
SAE-750431		UK-766-Interim	
	HS-016 524		HS-801 52
SAE-750432		UM-HSRI-AL-74-8	
	HS-016 525		HS-801 43
SAE-750433		UM-HSRI-BI-74-2	
	HS-016 526		HS-801 55
SAE-750434		UM-HSRI-BI-74-2-1	
	HS-016 527		HS-801 55
SAE-750436		UM-HSRI-BI-74-2-3	
	HS-016 535		HS-801 55
SAE-750438		UM-HSRI-BI-74-3	
	HS-016 536		HS-016 50
SAE-750459		UM-HSRI-HF-73-15	
	HS-016 706		HS-016 64
SAE-750461		UM-HSRI-PF-74-10	
	HS-016 537		HS-016 64
TJ-102-019		UTEC-ME-74-043	
	HS-801 527		HS-801 51
	HS-801 530	VRI-8.2	
			HS-016 50
TRB-SR-151		ZQ-5180-L-1	
	HS-016 655		HS-801 50
TRR-520			HS-801 50
	HS-016 650		HS-801 50
			HS-801 51

## **CONTRACTS AWARDED**



## LABORATORY TEST PROCEDURES

Ninety-four (94) retard pneumatic tire tests (passenger car) for conformance to FMVSS 117, Section 5.2.1 and 5.2.2 will be made.

Smithers Scientific Services 425 West Market St. Akron, Ohio 44313

No change  
\$7,990.00

DOT-HS-4-00936 Task Order No. 3

## VEHICLE OCCUPANT EJECTION STUDY II

Based upon a January 1975 report entitled "Dimensions of Vehicle Occupant Ejection" several variables were found to be closely associated with the ejection problems. The variables are to be explored more fully by use of multi-variate analysis. Data from 1971, 1972, and 1973 for vehicles involved in all accidents and for accidents involving two vehicles will be used. The given data on the number of vehicles involved; total number of persons injured; total number seriously injured; all injured ejectionees in 1000 accidents; all seriously injured ejectionees; and, a fraction of occupants wearing belts will be subjected to appropriate statistical analysis and a complete final report prepared.

State of New York Department of Motor Vehicles Empire State Plaza Albany, N.Y. 12228  
To be completed 30 Dec 75  
\$10,988.57

DOT-HS-4-00967 Amend. No. 4

## STATE DRIVER IMPROVEMENT ANALYSIS

Public Systems, Inc. 1137 Kern Ave. Sunnyvale, Calif. 94086  
Extended to 30 Sep 75  
No change

DOT-HS-5-01121 Amend. No. 1

## TRAFFIC LAWS COMMENTARY

A Traffic Laws Commentary "Flashing Lights on Emergency Vehicles" will review all State laws as of January 1, 1975, relating to the use of flashing red, blue, or white lights on emergency vehicles, such as those motor vehicles delivering police, fire, or medical services. The Commentary will include a review of laws relating to flashing lights used by vehicles engaged in highway maintenance operations, wrecker services, rural letter carriers, farm tractor vehicles, and private cars of volunteer and paid firemen responding to an emergency call.

National Committee on Uniform Traffic Laws and Ordinances 1776 Massachusetts Ave., N.W., Suite 430 Washington, D.C. 20036

No change  
\$13,000.00

DOT-HS-5-01158 Amend. No. 1

## UNIFORM TIRE QUALITY GRADING TESTING FACILITY

Department of the Air Force HQ6940th Air Group (USAFSS) Goodfellow Air Force Base, Texas 76901  
No change  
Increased \$24,130,000 c L

DOT-HS-5-01179

## A STUDY OF DRIVER BEHAVIORAL ERRORS IN ALCOHOL, MARIJUANA, AND OTHER DRUG-INVOLVED COLLISIONS

To meet the research objectives, the contractor shall conduct special human factors investigations of accidents involving the use of alcohol, marijuana, or other drugs by a driver, and of a control group of accidents not involving the use of alcohol, marijuana, or other drugs by a driver, comparing appropriate data between the two groups to determine any significant differences in driver behavioral information of the collisions. Based upon the results of this research, potential problem areas that may be useful in countermeasure development and any countermeasures which have the potential of reducing these problem areas shall be identified. 0en

Calspan Corporation 4455 Genesee St. Buffalo, N.Y. 14221  
To be completed fifteen (15) months from date of contract award  
\$150,810.00

DOT-HS-5-01180

## COMPUTER SIMULATION OF HUMAN THORACIC SKELETAL RESPONSE AND RIB FRACTURE

The general objective of research is to develop an existing finite element computer model of the human thorax (THORAX) to the point where it has been demonstrated, by favorable comparison with experimental data developed elsewhere, to predict dynamic structural responses and rib fractures for the human cadaver. Coordinating with the Highway Safety Research Institute (HSRI) in an experimental effort involving fresh cadaver chest impact tests the contractor will inform HSRI of measurements which would be useful in this contract and will seek information from HSRI in support of this contract. An effective strategy to adequately account for the interactions of the impactor for test data to be used; a study of potential models for rib fracture that could be implemented into the computer program THORAX; and, a study to determine the simplest effective strategy for accounting for the affects of the thoracic contents on the rib cage are to be developed. In the course of simulations of human cadaver impact tests that involve rib fracture, the contractor shall establish a rib failure model and a computer simulator of rib structural responses. Simulation tests will be made involving

human cadavers restrained by belts, and those restrained by air bags.

The Franklin Institute The Benjamin Franklin Parkway  
Philadelphia, Pa. 19103  
To be completed twelve (12) months from date of contract  
award  
\$145,695.00

DOT-HS-5-01181

## **MOTORCYCLE SAFETY IMPROVEMENT**

The initial phase of the National Highway Traffic Safety Administration (NHTSA) sponsored Motorcycle Safety Improvement Program found that control cable strength and reliability, cornering clearances, and fuel system integrity were areas showing promise for cost-effective improvement. Further investigation in these three areas will be done to determine if formal rulemaking is feasible and/or desirable. In attempting to finalize a test procedure which is representative of in-service usage and life expectancy for all types of motorcycle control cables, a survey will be made of typical failure modes encountered in control cables and related attachment points. Frequency of the different failure modes and the implications or consequences of such failures will be discussed. Based on the survey results, a test plan and test fixture will be prepared in order to investigate reliability and performance parameters of interest, including strength and fatigue. Capabilities of motorcycle riders of average and relatively little experience will be utilized to record banking angle and suspension compression front and rear during all types of maneuvers. Riding environment and roadway surface condition will be varied to determine the effects of pavement irregularities. Differences in motorcycle parameters will also be investigated for their effects on cornering clearance and its related safety significance. Results of rider capability investigation will be combined with the results of the investigation of the machine variables to produce the most viable and safety significant criteria for minimum cornering clearances. A sample of fuel tanks and fillers representative of various shapes, construction materials, mounting configurations, and usage for present production motorcycles will be used to finalize and validate the preliminary performance specification for motorcycle fuel system integrity. The test results will be evaluated and the preliminary specification amended and updated as deemed necessary. 01on

AMF, Advanced Systems Laboratory 495 So. Fairview Ave.  
Goleta, Calif. 93017  
To be completed twelve (12) months from date of contract  
award  
\$117,253.00

DOT-HS-5-01188 Amend. No. 1

## **MANUAL BRAKE INSPECTION PROCEDURE**

Avco Systems Division 201 Lowell St. Wilmington, Mass.  
01887  
No change  
Increased \$69,510.00

DOT-HS-5-01207

## **EMERGENCY MEDICAL TECHNICIAN - AMBULANCE: ADVANCED COURSE**

A course guide, presenting a complete training plan including course objectives, content, achievement standards and schedules, will be developed. Instructor lesson plans, a student guide which will serve as a working reference book on the job, and a training course for enrollees will be produced. Using these tools and a key emergency medical instructor, training institutes of three (3) day duration will be conducted.

University Health Center of Pittsburgh Room 346, Falk  
Clinic/Ambulatory Care Program 3601 Fifth Ave. Pittsburgh,  
Pa. 15213

To be completed nine (9) months from date of contract award  
\$54,804.00

DOT-HS-5-01208

## **DEFOG TEST PROCEDURE**

Various laboratory procedures for vehicle defoggers which could be used as a compliance test procedure for FMVSS 103, "Windshield Defrosters and Defoggers", will be tested. Following selection or formulation of a test procedure to measure the quality of motor vehicle defogger systems on all glazing surfaces, the contractor will test five (5) 1975 model vehicles. Results of the test procedure will be evaluated and recommendations of changes considered necessary to improve the capability of the test procedure to discriminate good from bad defogger systems will be made. Adaptability to future tests on larger vehicles and other defogger systems are to be considered in making this evaluation. Capability of the test procedure to be an evaluative agent for inclusion into a Federal motor vehicle standard is to be reported.

Ultrasystems, Inc. Dynamic Service Division 1850 W. Pinnacle  
Peak Rd. Phoenix, Ariz. 85027  
To be completed five (5) months from date of contract award  
\$34,691.00

DOT-HS-5-01209

## **POLICE MANAGEMENT TRAINING ON FACTORS INFLUENCING DWI ARRESTS: TRAINING STATE AND COMMUNITY INSTRUCTORS**

Training materials for police managers at all levels, consisting of a course guide, a student study manual, and instructor lesson plans, have been developed previously. The present project will present these training materials to a group of potential instructors of users in a workshop for educators and training officers in police training programs. Instructor trainees will be solicited from junior colleges, colleges and universities having courses in police management and from among the training officers of large police departments who have the responsibility for developing and conducting in-service police management training programs. A thirty (30) hour training course to

selected instructors will acquaint the enrollees with the requirements of the course and site locations will be assigned.

Applied Science Associates, Inc. Box 158 Valencia, Pa. 16059  
To be completed twelve (12) months from date of contract award  
\$53,457.00

DOT-HS-5-01210

### **YOUTH, ALCOHOL AND SPEEDING**

The contractor will submit an experimental plan to determine whether a combination of drinking and speeding is significantly more risky for young drivers than for the general driving population, and to determine the effects of a speeding/had been drinking citation. By identifying, securing, and analyzing existing data, including police and traffic engineering accident and location reports, the contractor will endeavor to construct tables for youth accidents, and for adult accidents, to determine if the risk of combining speeding and drinking was significantly higher for youths than for adults. If interaction effects were found for youths alone, or separately for both youths and adults, an appropriate statistical test will be made between the two interaction groups to determine whether the risk of combining speeding and drinking is significantly higher for youths than for adults. In addition, subjects will be recombined into two tables, consisting of inexperienced drivers (six months or less) vs. experienced drivers (two years or more) and an analysis parallel will be conducted. Final analysis is to be a comparison of data involving inexperienced youths vs. experienced youths. Existing data should allow the contractor to determine the impact on accident rates of legislation governing speeding violations by drivers who have been drinking in one or more states where such legislation currently exists. cap

American Institutes for Research 3301 New Mexico Ave.,  
N.W. Washington, D.C. 20016  
To be completed twelve (12) months from date of contract award  
\$83,682.00

DOT-HS-5-01211 IA

### **HIGHWAY SAFETY NEEDS STUDY FOR INDIAN RESERVATIONS**

Focusing on the identification of highway safety problem areas for the various Indian tribal governments, highway safety needs and their implementation costs will be determined for potential impact on fatality and accident reduction. No less than ten (10) and no more than fifteen (15) reservations will be surveyed to determine and develop a strategy for solving problems in terms of identified needs and their costs for implementation during the period 1977-1986. A current assessment survey will be made to identify and describe major highway safety problem areas for study and to present a narrative on possible areas where the Indian nations, the States and Federal government may work together to enhance the highway safety program activities on the Indian reservations.

U. S. Department of Interior Bureau of Indian Affairs  
Washington, D.C. 20242  
To be completed 14 Nov 75  
\$99,847.00

DOT-HS-5-01213

### **MANAGEMENT AND SUPPORT OF SIXTH INTERNATIONAL TECHNICAL CONFERENCE ON ESV'S**

Overall arrangements for the conference will be made. This will include conference rooms, microphones, projectors, view-graph projectors, an interpreter, bi-lingual hostesses, and around-the-clock security of the conference area. 0 le

Sherraton National Motor Hotel 900 South Arme St. Arlington, Va. 22204  
12-15 Oct 75  
\$50,890.00

DOT-HS-5-01216

### **CRITICAL INCIDENT STUDY OF VEHICLE CRASH AVOIDANCE SYSTEMS**

In adapting the critical incident technique to highway safety the emphasis should be on collecting data associated with driver errors and unsafe conditions which contribute to near accidents. By surveying a large sample of drivers and questioning them about some critical incident involving a near miss they may have experienced while driving, the contractor will collect near miss data to help determine what problems exist with vehicle crash avoidance systems, what improvements are needed in vehicle crash avoidance systems, what role these systems play in accident avoidance, and what additional vehicle systems or components might be effective accident countermeasures. The specific systems of interest include control/display systems, rearview mirrors, braking, steering, lighting and signaling, seating and driver workspace, and diagnostic systems which indicate actual or impending equipment failures. Data obtained is to be analyzed, and recommendations are to be made which will help obtain greater insights into the role of vehicle systems in crash avoidance by using the critical incident technique.

Dunlap & Associates, Inc. 115 South Oak St. Inglewood, Calif. 90301  
To be completed fifteen and one-half (15 1/2) months from date of contract award  
\$99,756.00

DOT-HS-5-01217

### **STATE OF KNOWLEDGE AND INFORMATION NEEDS IN ALCOHOL/DRUGS AND HIGHWAY SAFETY**

Available literature on the alcohol/crash and driving behavior situation will be surveyed and evaluated. Results which provide valid information pertinent to the alcohol/highway safety problem will be combined and summarized to constitute a report to be used by the Department of Transportation (DOT) as an alcohol highway safety information source for State and local, as well as other potential user groups. It should be designed so that the information provided can be used by these agencies for activities such as legislative program planning, traffic regulation specification, and enforcement planning. In reviewing the research results special attention shall be directed toward alcohol in crashes and violations;

physiological effects of alcohol; laboratory or controlled field research on alcohol and driving behavior; and alcohol/crash countermeasures including alcohol safety interlock systems, roadside breath testers, and sobering agents. In addition, the contractor will examine relevant literature and prepare a comprehensive outline of the research required to determine the incidence of drugs in the highway accident population and their influence on driver behavior. Drug/highway safety research requirements that have been inappropriately examined, need further investigation because of conflicting results, and have not been empirically investigated, are to be specified and a priority ranking of future research efforts in terms of potential impact on identification of the problems are to be specified.

Indiana University Department of Forensic Studies 302  
Sycamore Hall Bloomington, Ind. 47401  
To be completed 23 Jun 76  
\$99,847.00

DOT-HS-5-01218

### **COMPLIANCE TECHNIQUES FOR PEDESTRIAN PROTECTION FEASIBILITY STUDY**

Recent research has demonstrated that structures simulating the bumper and hood edge of an automobile striking a standing cadaver cause significant trauma to the areas of the tibia, fibula, knee, femur, and the pelvis. This effort also exhibited the injury mitigating potential of a specific compliant bumper and hood design. Using the results of such effort, the contractor shall devise a compliance methodology and criteria for the incorporation of injury mitigating potentials in the front on motor vehicles; design, fabricate, and test a compliance test device(s), and demonstrate that the resulting methodology and test requirements do generate structures which are consistent with the intent of this compliance technique and criteria. Following the design and fabrication of a dynamic testing device which will determine whether injury mitigating features are incorporated in the front ends of motor vehicles, eight (8) impact tests equivalent to a cadaver being struck by a car and using fresh cadavers, are to be conducted to help define the levels for compliance. Recommendations for correction and any further testing which may be necessary will be made.

Battelle Memorial Institute Columbus Laboratories 505 King Ave. Columbus, Ohio 43201  
To be completed eighteen (18) months from date of contract award  
\$338,056.00

DOT-HS-5-01219

### **SEMINARS FOR PROBATION-DIAGNOSIS REFERRAL PERSONNEL IN ALCOHOL HIGHWAY SAFETY PROGRAMS**

Seminars for training Alcohol Safety Action Project (ASAP) personnel concerned with the functions of probation, presence-ence investigation, diagnosis referral, and rehabilitation of

driving while intoxicated (DWI) offenders will be conducted in nine (9) additional sites.

Indiana University Foundation 355 N. Lansing St.  
Indianapolis, Ind. 46202  
To be completed eleven (11) months from date of contract award  
\$54,767.00

DOT-HS-5-01220

### **COPY TESTING AND TRACKING STUDY FOR ADVERTISING CAMPAIGN**

Copy testing for the National Highway Traffic Safety Administration (NHTSA) public service advertising is to evaluate whether the individual advertisements can influence attitudes toward drinking/driving that will lead to desired behavior, and whether the advertising message will be successful if it can obtain sufficient media exposure to overcome other environmental factors. Recruiting at random 450 individuals from three (3) shopping centers in each of three (3) cities, one group will be exposed to a show containing advertising, while the other is exposed to the same show without advertising. Objective is to provide feedback on those approaches, executional devices and techniques which do not work, and thus improve the effectiveness of subsequent communications. Members of the respective groups shall be interviewed immediately after exposure to the test on an individual basis. Questioning is expected to reveal participant's attitudes toward the commercials. This tracking research is intended to measure whether public service advertising provides sufficient exposure to accomplish desired goals. Telephone inquiries will be made also to ascertain ratings on the importance of ten (10) national problems: frequency of alcohol related situation (ARS) adult involvement; rating of from eight (8) to ten (10) fact-attitude scales relevant to perception of an individual who is potentially headed for a driving while intoxicated (DWI) experience; the likelihood of the interviewee's taking four (4) strategic countermeasures action; the interviewee's presence in a perceived DWI situation; actions he or she took to prevent another's DWI, or reasons for not taking action; recall of NHTSA advertising aimed at drunk driving, its source, including the medium, and its message; the interviewee's personal drinking habits; and, a demographic profile of the interviewee.

Grey Advertising, Inc. 777 Third Ave. New York, N.Y. 10017  
To be completed twelve (12) months from date of contract award  
\$71,637.00

DOT-HS-5-01225

### **PROGRAM PRIORITY AND LIMITATION ANALYSIS**

The necessary guideline criteria, computer program, and surveillance process for indicating the tolerable limits of the combined effects of all motor vehicle safety standards with respect to public acceptance and industrial impact will be developed. The goal of this effort is to provide tools, techniques, and guideline criteria for balanced management of all effects, both positive and negative, of safety standards collectively within reasonable and practicable limits of society. Public sensitivity to cost increases and long term financial burden for personal transportation shall be quantitatively defined and expressed in



October 31, 1975

DOT-HS-5-01230

the form of tolerable annual price increase for new vehicles, tolerable increase in operating costs for fuel, service and maintenance, and tolerable long term cumulative cost increases attributable to safety. Vehicle design changes, vehicle dimensions, weight, performance, and human/vehicle interface aspects are all factors involved.

The Center for the Environment and Man, Inc. 275 Windsor St. Hartford, Conn. 06120

To be completed twelve (12) months from date of contract award  
\$91,825.00

DOT-HS-5-01227

#### **DATA COLLECTION AND ANALYSIS REHABILITATION EVALUATION IN THE DENVER ASAP AREA**

Certain basic criterion and performance data is to be collected and reported in order to evaluate the post-ASAP alcohol countermeasure environment. Data on fatal single vehicle, multivehicle and pedestrian crashes, single vehicle, multivehicle and pedestrian injury crashes, blood alcohol level (BAC) data for drivers killed or arrested, and enforcement patrol activity data is to be utilized. An annual report giving background information on the Alcohol Safety Action Project (ASAP) community is to include significant community data such as population, licensed drivers, registered vehicles, vehicle and road miles, legislative and administrative changes, etc. and pertinent data on all countermeasures employed. Discussion of current progress and activity should show the positive or negative impact made on criterion measures due to withdrawal of Federal 403 countermeasure support. Short term rehabilitation evaluation is to be made of the treatment techniques as well as other most frequently used treatment modalities for the problem drinker. cie

State of Colorado Division of Highway Safety 4201 East Arkansas Ave. Denver, Colo. 80222

To be completed 30 Jun 77  
\$78,321.00

DOT-HS-5-01228

#### **FIELD TEST EVALUATIONS OF REAR LIGHTING AND SIGNALLING SYSTEMS**

Selected innovative rear lighting and signalling systems are to be evaluated by means of on-the-road tests. Systems under study shall be incorporated into automobile fleets and operated under general everyday service over an extended period of time. Comparisons of accident data among the selected systems shall be made, as well as comparisons with a representative sample of rear lighting systems in use today. Types of lighting and signalling systems to be used are: the rapid deceleration signal; dual high mounted signal lamps; single high mounted stop signal lamp; high-mounted turn signal lamps, single high-mounted stop signal lamp and rapid deceleration signal; and, separate stop and presence lamps. 0 ne

DOT-HS-5-01229

#### **COLLECTION OF NATIONAL TREND DATA ON ALCOHOL RELATED CRASHES FOR COMPARISON WITH ASAP RESULTS**

The National Highway Traffic Safety Administration (NHTSA) has a requirement for the development of data which can be used for comparison with fatality and injury crash data trends at the Alcohol Safety Action Project (ASAP) sites. This will enable NHTSA to determine whether changes seen in only these projects reflect national changes or are unique to the sites and therefore may be the result of the ASAP activities. Aside from the evaluation of the Alcohol Safety Action Projects themselves, NHTSA has a need for a general measure of the numbers of alcohol-related crashes occurring annually. The contractor will collect a sample of national trend data in this area for comparison with the results of the NHTSA ASAP program to determine the trend in alcohol related crashes for the last ten (10) year period, 1965-1974, utilizing data available in State accident files, and to develop a seven (7) year trend, 1968-1974, in a group of communities selected to be an appropriate control for the 35 ASAPs.

Stanford Research Institute 333 Ravenswood Ave. Menlo Park, Calif. 94025

To be completed ten (10) months from date of contract award  
\$85,572.00

DOT-HS-5-01230

#### **ACCIDENT INVESTIGATION METHODOLOGY TO ASSESS THE ROLE OF VEHICLE BRAKING PERFORMANCE ON HIGHWAY SAFETY**

A workable methodology is to be developed which will specify field investigation techniques, reporting procedures, and analysis methods to assess the actual and potential role of vehicle braking performance on accident prevention and severity reduction based on accident investigation and the analysis of data acquired through such investigations. An appropriate, relevant set of braking parameters will be selected for study and analysis as to their actual and potential role in accident avoidance and severity reduction. Assessment of these parameters shall include but not be limited to pedal force requirements, modulation, fade, in-use degradation, tire-road interaction, wet brake performance, etc. A systematic, semi-automatic procedure is to be developed to iterate or otherwise manipulate an appropriate vehicle braking simulation program which can reconstruct the vehicular linear motion history using data obtained through accident investigation as input. Methodology thus developed will define the appropriate field investigation techniques, reporting procedures and analysis methods to accomplish the objectives of this contract. On (

Calspan Corporation 4455 Genesee St. Buffalo, N.Y. 14221  
To be completed eighteen (18) months from date of contract award  
\$117,490.00

DOT-HS-5-01231

HSL 75-10

DOT-HS-5-01231

### **INVESTIGATION OF MOTOR VEHICLE/BICYCLE COLLISION PARAMETERS**

Increase in the use of bicycles for transportation and recreation has increased the exposure to other vehicular traffic as well. A rise in the number of bicyclist's deaths and injuries, resulting from bicycle-motor vehicle accidents, has prompted this study to identify the causal factors of such accidents especially driver/bicyclist behavioral errors; to study the accident severity in relation to the vehicle exterior design and collision configuration and make recommendations for design changes if feasible; and, to identify factors which lead to bicyclist injuries. To gain the necessary statistics for determination, accidents will be reconstructed, vehicle dynamics and bicyclist's kinematics will be determined, vehicle contacted areas and injury producing elements will be identified, and all relevant data in general will be analyzed to find the accident/injury causation.

University of Southern California University Park Los Angeles, Calif. 90007

To be completed twenty-four (24) months from date of contract award  
\$322,210.00

DOT-HS-5-01232

### **KINESIOLOGY OF THE HUMAN SHOULDER AND SPINE**

Both human volunteer subjects and cadaveric specimens will be used in experiments to derive adequate biomechanical fidelity specifications to define both statically and dynamically the performance of the human spine and shoulder during events typical of frontal, oblique, lateral, and rear automotive crash configurations. Analysis will be made of such data to identify significant kinematic and kinetic parameters; mechanical analogs will be proposed; and, actual mechanical devices which are capable of being installed in present anthropomorphic test devices will be designed, constructed, tested, evaluated and redesigned if necessary.

Wayne State University Research & Sponsored Programs Services 5050 Cass Ave. Detroit, Mich. 48202

To be completed 30 Jun 77  
\$379,100.00

DOT-HS-5-01233

### **THE EFFECTS OF ALCOHOL ON THE DRIVER'S VISUAL INFORMATION PROCESSING**

Using a group of adult males with at least two (2) years of driving experience and who can attain a 0.15 blood alcohol level (BAC) in a pretrial test session, data showing head tracking error, velocity command error, route errors, and eye point of regard will be recorded. This should enable the contractor to investigate the effects on the driver's response to a set of visual tasks by the measurement of eye movement recording techniques in an experimentally controlled situation. The purpose is to determine if an intoxicated driver's

reaction developed shall be used to identify countermeasures approaches suitable for overcoming alcohol related visual information processing problems.

Southern California Research Institute 4138 Royal Crest Place Encino, Calif. 91316

To be completed twelve (12) months from date of contract award  
\$153,949.00

DOT-HS-5-01234

### **LORAN-C CONCEPTUAL ANALYSIS AND FEASIBILITY DEMONSTRATION PLAN**

Loran-C is a pulsed low frequency (LF) hyperbolic radionavigation system which has been operating as a U.S. military system primarily overseas for over fifteen (15) years. The U. S. Coast Guard is presently in the process of providing its coverage for the Coastal Confluence Zone (CCZ). The CCZ will necessarily overlap approximately 75% of the continental United States. Accuracy of the system and its availability indicate that Loran-C may be the economical solution to roadway site location requirements. The contractor is to investigate, evaluate, and determine whether Loran-C can economically satisfy traffic safety requirements for precision position identification in New York State and if so, how. Highway accident locations and a collection of highway descriptive characteristics and law enforcement requirements must be satisfied in both rural and urban situations.

State of New York Traffic Records Project South Swan Street Building Albany, N.Y. 12228

To be completed one (1) year from date of contract award  
\$60,000.00

DOT-HS-5-01237

### **INVESTIGATION OF POSSIBLE SAFETY-RELATED DEFECT PROBLEMS**

Procedures and pricing methodology need to be established for the issuance of task orders for the completion of safety-related defect (SRD) investigation requests from private citizens, elected officials, consumer groups, and other governmental agencies. To accomplish this the contractor will locate a specified number of owners of vehicles which have been cited as defective, examine the defective component, diagnose the problem and report on it to the National Highway Traffic Safety Administration (NHTSA).

Connecticut Motor Club 2276 Whitney Ave. Hamden, Conn. 06518

To be completed twelve (12) months from date of contract award  
\$50,000.00

DOT-HS-5-01238

### **STATE PUBLIC INFORMATION AND EDUCATION SEMINARS ON ALCOHOL AND HIGHWAY SAFETY**

October 31, 1975

DOT-HS-5-01244

among responsible officials and professionals, and to help create public support for control and treatment measures, training seminars will be designed to upgrade the effectiveness of State programs and public information and education for highway safety with strong emphasis on alcohol and highway safety. These regional seminars on alcohol and highway safety will be conducted at three (3) sites for three (3) participants from each State.

Grey Advertising, Inc. 777 Third Ave. New York, N.Y. 10017  
To be completed six (6) months from date of contract award  
\$45,886.00

DOT-HS-5-01239

#### **TRAFFIC RECORD ASSOCIATE DEGREE: PILOT PROGRAM**

An accredited community college will be selected to develop and present a 2-year associate degree curriculum for the training of traffic records analysts. The curriculum shall incorporate the work performance criteria and student behavioral objectives essential to employment and progress in the traffic records field. The contractor shall monitor, report on progress and provide recommendations to guide the participating school and the National Highway Traffic Safety Administration (NHTSA). The curriculum shall incorporate to the fullest extent practicable all substantive traffic records resources including materials published through NHTSA and the pertinent State traffic safety agencies. A model curriculum with guideline information shall be produced for publication, dissemination and use in establishing and operating similar programs at other institutions. 0tis

American Association of Community and Junior Colleges One Dupont Circle Washington, D.C. 20036  
To be completed 1 Sep 77  
\$31,062.00

DOT-HS-5-01241

#### **SELF TEST DEVICES**

It has been hypothesized that individuals may change their drinking and driving behavior if they know the degree of their blood alcohol level (BAC) impairment. Upon selection of at least two (2) different driving situations, the contractor shall determine the method of presenting the information to the people at these drinking situations, how to encourage them to take a breath test, and how to present them with the results. The information presented shall include the relationship between BAC level, highway accidents, the law and alternatives to driving while impaired by alcohol. Data will be collected on the BAC level of those people who took the breath test; behavior of the subjects after being given BAC information; driving behavior of the people upon leaving the control site during the test period and at both the test and control sites during the baseline period; interview data from a sample of subjects at the control site and the test site; and, important situational data such as was the person alone, etc. Data will be

tion influenced the attitudes of the people who took the test and the reasons for changing or not changing their behavior.

Dunlap & Associates, Inc. One Parkland Drive Darien, Conn. 06820

To be completed twelve (12) months from date of contract award  
\$81,412.00

DOT-HS-5-01242

#### **PSYCHOPHYSICAL TEST FOR DWI ARREST**

Currently used physical coordination tests to determine their relationship to intoxication and driving impairment will be evaluated. More sensitive tests that would provide better evidence of intoxication and have a closer relationship to driving impairment will be developed and tests and observation procedures are to be standardized. An experimental evaluation of tests studied shall be made for comparison of the psychophysical tests during performance, and the blood alcohol level (BAC) of the drivers. Recommendations following this evaluation shall include the relative merit of each test studied and identify the best combination of tests that represent impairment of driving due to alcohol intoxication. A small readable handbook on psychophysical tests that would be suitable for use by police officers will be prepared. ne

Southern California Research Institute 4138 Royal Crest Pl. Encino, Calif. 91436

To be completed twelve (12) months from date of contract award  
\$110,185.00

DOT-HS-5-01243

#### **TRAFFIC SAFETY PROGRAM MANAGEMENT FELLOWSHIP AND INTERNSHIP - MODEL PROGRAM DEVELOPMENT**

Development of a model master's degree program in traffic safety program management will define the curriculum and internship requirements and will include an analysis of the program management job requirements and the characteristics of the student population from which candidates will be selected. A pilot test will allow for five (5) internships and seven (7) fellowships. The master's degree program will be a multidisciplinary option within the traditional master's degree program in public administration.

University of Southern California University Park Los Angeles, Calif. 90007

To be completed thirty-two (32) months from date of contract award  
\$293,416.00

DOT-HS-5-01244

#### **REVISION OF NHTSA CURRICULUM PACKAGES**

dard format is to be devised for revision of such of these packages as necessary, and the revision submitted which will provide the Government Printing Office with the documentation necessary to publish revised editions of the selected NHTSA curriculum packages. str

Dunlap & Associates, Inc. One Parkland Drive Darien, Conn. 06820

To be completed eleven (11) months from date of contract award  
\$59,545.00

DOT-HS-5-01245

### **SOBERING AGENT: EFFECTIVENESS MEASUREMENT AND DEVELOPMENT**

Based on the approach of neutralization of the alcohol impairment in the brain, the contractor will determine the effectiveness of selected potential sobering agents to reduce alcohol related driving performance impairment, and develop the research plans needed to complete the development of a practical agent and to validate its effectiveness. A number of possible sobering agents to be administered orally will be tested. Criteria for agent selection will include: degree of sobering, absence of side effects, quickness of onset, and duration of effectiveness. Effectiveness tests will be selected based on relevance to driving performance and objective evaluation of the degree of intoxication. Consideration shall be given to the selection of subjects to represent high alcohol crash risk groups. Following medical examination and alcohol consumption, the proposed agent or placebo shall be given. Performance impairment will be tested, breath alcohol tests or inhalation tests will be performed, and analysis of variance will be used for evaluation with each subject as his own control, unless a better technique is justified.

Southern California Research Institute 4138 Royal Crest Place Encino, Calif. 91316

To be completed twelve (12) months from date of contract award  
\$145,286.00

DOT-HS-5-01248

### **HANDBOOK FOR EVALUATION OF DEMONSTRATION PROJECTS IN TRAFFIC SAFETY**

Methodologies and techniques currently being used to evaluate the National Highway Traffic Safety Administration (NHTSA) demonstration projects are to be combined and a manual developed which will be applicable as a reference document and guide for evaluation of most traffic safety demonstration projects. Intended users of the manual will be persons in State and local governments interested in applying for NHTSA demonstration project funding, persons interested in State and local governments in using the most up-to-date methodology to develop and evaluate their own demonstration projects, and staff of NHTSA regional and headquarters specialists who are called upon to consult with or manage demonstration projects. on

Teknekron, Inc. 1019 19th St., N.W. Washington, D.C. 20036  
To be completed eight (8) months from date of contract award  
\$61,400.00

DOT-HS-5-01249

### **COORDINATION CENTER FOR HIGHWAY SAFETY COMMUNICATIONS**

Intent is to establish a mass communications coordination center in the Washington, D.C. metropolitan area to facilitate a unified national effort using mass media to combat drunken driving. This mass communication center is to promote the use of the National Highway Traffic Safety Administration (NHTSA) studies and advertising materials by public information practitioners and the media. It will have the responsibility of helping to place public service advertisements on radio and television and in newspapers in the Washington metropolitan area. Through its coordination and consultative assistance to State and local agencies it will encourage further use of NHTSA campaign materials.

Grey Advertising, Inc. 777 Third Ave. New York, N.Y. 10017  
To be completed twelve (12) months from date of contract award  
\$112,866.00

DOT-HS-5-01250

### **TECHNIQUES FOR PREDICTING HIGH RISK DRIVERS FOR ALCOHOL COUNTERMEASURES**

the major objective of this study is to develop and validate predictive techniques which will allow the identification of individuals with a high probability of being involved in alcohol-related (A/R) accidents so that effective countermeasures can be instituted on the target population. A second objective is to identify feasible countermeasures applicable to each target population. Using selection criteria previously established, the contractor shall identify subpopulations of individuals with potentially high risk characteristics. In addition a random sample from the general driver population will be selected for further study. Other secondary variables for analysis will be obtained from past driving records and biographic-demographic data and used to develop risk prediction instruments for each of the samples. The contractor shall submit an alcohol countermeasure plan and a validation study plan as well as determine incidence, a risk factor and impact of A/R accidents for each sample. 0ach

University of North Carolina Highway Safety Research Center Craige Trailer Park-South Campus Chapel Hill, N.C. 27514  
To be completed twenty-four (24) months from date of contract award  
\$133,068.00

DOT-HS-5-01252

### **STATE DRIVER LICENSING AGENCY HEARING AUTHORITY**

A survey of the composition and nature of State driver licensing agency hearing authority (DLAHA) as it relates to highway safety will be made, and determination of the state of development of State DLAHA in terms of hearing officer professionalism, job qualifications, organizational integration and legal and administrative procedures will be established. The contractor will then create a model DLAHA organizational structure to reflect budget, function, staff, department-

siderations. Special emphasis should be given to the nature and scope of hearing authority, its legal, budget, personnel, procedure and administrative components and its organizational position and integration into the licensing agency regulatory activities. and

Arthur Young & Company 1025 Connecticut Ave., N.W.  
Washington, D.C. 20036  
To be completed twelve (12) months from date of contract award  
\$74,886.00

DOT-HS-5-01253

### **SURVEY ANALYSIS OF SHORT TERM APPROACHES TO THE REHABILITATION OF CONVICTED DWI'S**

Focusing attention on the needs for further research, development, and evaluation of all short-term rehabilitation (STR) programs, program components, and STR objectives of those having the greatest potential for effectiveness, the contractor shall identify groups of convicted drivers by severity and characteristics of their drinking problem and causes of their drinking behavior, and the specific objectives of STR for each drinker group. He shall identify the various approaches which have been developed and various follow-up techniques which could be added, along with the evidence, theoretical or real-world, that those approaches are or can be effective in reaching the objectives of STR. Specifications for integrated STR programs with follow-up are to be developed to meet the objectives for specific groups of drinkers. Specific areas most in need of further research and evaluation will be identified. 0 al

McBer and Company 137 Newbury St. Boston, Mass. 02116  
To be completed eight (8) months from date of contract award  
\$74,057.54

DOT-HS-5-01254

### **DEVELOPMENT OF THE ASPIRATION INFLATION TECHNIQUE FOR SUBCOMPACT CARS: FRONT-SEAT PASSENGER**

Previous research has demonstrated that 50-mph protection using the aspirator concept is achievable for passengers of the standard-size car. Using essentially that aspirator concept, development of an air cushion restraint system capable of providing frontal crash protection, over a range of anthropometric sizes, to the front-seat passenger of subcompact cars in crashes up to a severity equivalent to 50-mph head-on flat barrier will be tested. Dimensions of the air cushion restraint system developed must be such that it fits physically within the contours of the dashboard of the subcompact vehicle selected for testing. Crash performance of the system will be investigated via full-scale simulated crash tests with anthropometric dummies. Testing will involve both frontal and head-on crashes. 0ers

Calspan Corporation 4455 Genesee St. Buffalo, N.Y. 14221  
To be completed twenty-four (24) months from date of contract award  
\$342,030.00

DOT-HS-5-01255

### **STATISTICAL ANALYSIS OF LEVEL 2 RESTRAINT SYSTEMS DATA FILE (TASKS 1-5) ANALYSIS ON A RESTRAINT SYSTEMS DATA FILE COLLECTED BY 5 INDEPENDENT CONTRACTORS (TASK 6)**

A restraint system is part of the National Highway Traffic Safety Administration (NHTSA) program to evaluate crash injury countermeasures. A key element of this study is a "level 2 data file" for the specific purpose of statistical analysis of injury reducing effectiveness of belt restraint systems. The file is based on a probability sample of roughly 10,000 towaway accidents and provides detailed information on occupant injury, belt usage and other variables related to crash injury production. A multivariate analysis is to be used to estimate injury rates that unrestrained occupants would have experienced in crashes if they had used various belt systems. The same method is to be used to test relevant hypotheses about the seat belt interlock system, the large car small car problem, and the effectiveness of seat belts in specific crash configurations.

University of North Carolina Office of Research  
Administration South Building Chapel Hill, N.C. 27514  
To be completed eight (8) months from date of contract award  
\$92,318.00

DOT-HS-5-01256

### **ADVERTISING MATERIALS PRODUCTION**

Public education activities must help people to understand and recognize the seriousness of excessive drinking and driving, and make them aware of their personal responsibility to act on behalf of another. Approach is to encompass professional, official and private groups in an effort to educate the public through advertising media. Three (3) public service spot announcements for television, twelve (12) public service spots for radio, print ads for magazines and newspapers, brochures and posters, all directed at the general audience and youth oriented, are to be developed.

Grey Advertising, Inc. 777Third Ave. New York, N.Y. 10017  
To be completed twelve (12) months from date of contract award  
\$235,831.00

DOT-HS-5-01257

### **EFFECTS OF ALCOHOL AND MARIHUANA ON DRIVER CONTROL BEHAVIOR**

This study is to determine the effects of alcohol and marihuana on driver control behavior, in particular heading and lateral path control, and to relate these effects to critical reasons for accident causation. A laboratory study using a part task simulator will be conducted, and an in-vehicle test using an instrumented vehicle, the Driver Performance Measurement and Analysis System (DPMAS), on a closed course will be made. These studies shall evaluate the effects of alcohol and marihuana by measuring the driver/vehicle response characteristics. In addition, manual control theory shall be used to measure driver control behavior. The information developed from this study will be used to identify potential countermea-

sure approaches that should be explored to reduce alcohol related crashes caused by driver control failure and to determine whether marihuana is a potential highway safety problem. 01em

Systems Technology, Inc. 13766 S. Hawthorne Blvd.  
Hawthorne, Calif. 90250  
To be completed twenty-four (24) months from date of contract award  
\$284,705.00

#### DOT-HS-5-01259

### IDENTIFICATION OF UNSAFE DRIVING ACTIONS AND RELATED COUNTERMEASURES

The human element in the highway transportation system is a primary causal factor in motor vehicle accidents. The majority of accidents, however, are not attributable to a minority of accident prone drivers but appear to involve otherwise normal drivers in moments of temporary impairment and/or dangerous driving actions that lead to a situation in which the demands of the system exceed their capabilities. The identification of unsafe driving actions (UDA), as defined within the context of the Safe Driving Conformance Research Program, will stem from a four-fold analysis: accident data bases will be examined to identify a preliminary set of UDA's; an assessment will be made of the frequency with which citations are issued for these actions; estimates of actual frequency of occurrence will be made via real-world observations; and a final analysis which identifies a selected set of unsafe driving actions, each being described in terms of its dynamics, driver characteristics, situational aspects, detection rate, and risk of accident occurrence. Potential countermeasures in the legal and social influence areas shall be identified for the developed UDA's. The UDA's shall then be ranked in terms of priority targets for countermeasure development and application. Recommendations shall also be made regarding research needed to validate UDA identification and to more fully define the UDA's where necessary. kel

The University of North Carolina Highway Safety Research Center Chapel Hill, N.C. 27514  
To be completed sixteen (16) months from date of contract award  
\$164,634.00

#### DOT-HS-5-01260

### EVALUATION OF NHTSA ADVANCED (S) SERIES 50TH PERCENTILE ANTHROPOMORPHIC TEST DUMMIES

A set of two (2) dummies, plus a third dummy to act as a control, will be subjected to a series of dynamic sled tests. Testing of the third dummy shall be performed during this program as a control to assure that the component test and sled test procedures are adequate. It is expected that the results derived from these tests will be employed in the adoption and standardization of a test dummy suitable for compliance testing.

Calspan Corporation 4455Genesee St. Buffalo, N.Y. 14221  
To be completed twelve (12) months from date of contract award  
\$127,840.00

#### DOT-HS-5-01261

### A STUDY OF RIGID POLYURETHANE FOAM

The contractor is to determine the physical characteristics and properties of polyurethane foam, especially properties which are most applicable for use in automobile structures such as flammability, energy absorption, ease of usage, and effects of degradation, among others. The study will cover every aspect of rigid polyurethane foam from raw material sources to disposability and recycling potential, and include all intervening areas such as physical properties, and its use in the automobile assembly process. Objective is to obtain the detailed information necessary to evaluate the short and long term applicability of this foam to automobile structures for high speed crash energy management. It is intended that this evaluation provide a definite conclusion as to whether or not rigid polyurethane foam is feasible for use in automobile structures. If it does prove feasible, a set of preliminary performance specifications will be drawn up which could be used in future rulemaking actions. Oyna

The Budd Company Technical Center 300 Commerce Drive Ft. Washington, Pa. 19034  
To be completed one (1) year from date of contract award  
\$133,490.00

#### DOT-HS-5-01262

### IMPROVEMENT OF ACCIDENT SIMULATION MODEL

A study of the simulation model of automobile collisions (SMAC) computer program which comprises approximately 4500 Fortran statements will be performed to assess the accuracy of SMAC as it is affected by tire forces, collision forces, and computational intervals.

Texas A&M Research Foundation F. E. Box Exchange H College Station, Texas 77843  
To be completed twelve (12) months from date of contract award  
\$80,405.00

#### DOT-HS-5-01263

### SAFE PERFORMANCE CURRICULUM PERFORMANCE MEASURES

A pilot test of the safe performance curriculum (SPC) materials, previously developed, revealed some weaknesses in performance tests and the perceptual skills tests needed to support the SPC demonstration project. Objectives of this effort are to improve the quality of the on-road performance test (ORPT) and the perceptual skills test (PST) associated with the SPC, and to determine the reliability of both tests and preliminary validity of the PST. A training program is to be conducted for appropriate personnel involved in the proposed demonstration of the safe performance curriculum in the use of the improved ORPT.

University of Southern California Institute of Safety and Systems Management Traffic Safety Center Los Angeles, Calif. 90007  
To be completed twelve (12) months from date of contract award  
\$59,584.00

October 31, 1975

DOT-HS-5-01270

DOT-HS-5-01264

## **MOTORCYCLE BRAKING PERFORMANCE**

The minimum performance requirements for motorcycle brake systems are specified in Federal Motor Vehicle Safety Standard (FMVSS) 122. This standard is to be examined to verify its design with regard to present motorcycle brake system performance and to recommend appropriate changes; to determine the direction and rate of evolution of motorcycle brake performance and make provision in the standard for this movement. The current baseline braking capability envelope for motorcycles is to be determined by testing a representative sample of motorcycles to the procedure of FMVSS 122. Since maximum performance capability is desired, the performance requirements of FMVSS 122 will be ignored when deemed to be suppressive of maximum capability of the brake system. This rational should apply to stopping distances, pedal and lever forces, procedures, sequences and conditions. Following evaluation of the current standard to verify its overall design as related to optimized motorcycle braking, performance recommendation of a next generation motorcycle braking performance standard will be made. This is to be based on the state-of-the-art of current motorcycle braking performance; performance improvements afforded by advanced concepts; applicable areas of the current standard; new objective tests required to overcome deficiencies in the current standard; and, new objective tests for special performance areas of advanced concepts.

The Regents of the University of Michigan 260 Research Administration Bldg. Ann Arbor, Mich. 48105  
To be completed fourteen (14) months from date of contract award  
\$169,570.00

DOT-HS-5-01266

## **ACCIDENT ANALYSIS - BREAKAWAY AND NON-BREAKAWAY POLES INCLUDING SIGN AND LIGHT STANDARDS ALONG HIGHWAYS**

In order to identify the extent of the accident problem associated with breakaway and non-breakaway poles, sign supports, and light standards; to determine the accident and injury severity rates involving motor vehicle collisions with such structures, and the relationship of such accidents to vehicle crash worthiness, highway design and operational characteristics including roadside design factors; and, to evaluate the performance and cost-effectiveness (injury severity reductions) of breakaway and non-breakaway sign supports and light standards through on-site accident reconstructions, an on-site investigation and analysis of accidents will be involved. The sample of accidents shall include urban and rural highways with varied average daily traffic and operating speeds. In the case of non-breakaway devices, all accidents, involving vehicles striking poles, sign supports and light standards wherein a victim of the accident was non-ambulatory or the vehicle was so severely damaged as to require towing from the scene, will be investigated. In the case of breakaway

DOT-HS-5-01268

## **DEVELOPMENT OF A TRAINING PROGRAM FOR DRIVER LICENSING ADMINISTRATIVE HEARING OFFICER**

A Driver Licensing Administrative Hearing Officer (DLAHO) is authorized to hear and adjudicate highway safety licensing agency cases. The DLAHO may hear traffic related offenses, judge relevant factors, make determinations, and recommendations for suspension of the driving privilege, for point assessment, or for other sanctions provided by law as well as driver rehabilitation assignments. The role of the hearing officer has a potential for improving traffic safety and so must be defined and studied in such a way that the actions of the hearing officer which relate to reducing death and injury can be carried out, and those actions which are ineffective can be eliminated. The contractor will study the goals, tasks, knowledge, skills and attitudes required of the hearing officer for the accomplishment of his safety related mission and develop a training program for its accomplishment. The training program will consist of a course guide for use by administrators in planning a training program, an instructor's manual, to be used by the trainer when conducting the course, and, a students manual-study guide, for use by the trainee.

Applied Science Associates, Inc. Box 158 Valencia, Pa. 16059  
To be completed eighteen (18) months from date of contract award  
\$49,749.00

DOT-HS-5-01269

## **USER'S MANUAL FOR PROBLEM IDENTIFICATION**

A manual designed for use by Governors' Highway Safety Representatives and other State and local government agencies will provide these organizations with the information necessary to analyze and collate the data required to perform problem identification for program planning and management. The scope of the manual will be limited to those data analysis techniques, processes, reports, etc. affecting problem identification and program planning.

National Driving Center 250 Engineering Annex Duke University Durham, N.C. 27706  
To be completed one (1) year from date of contract award  
\$49,101.00

DOT-HS-5-01270

## **IDENTIFICATION OF DWI BEHAVIOR PATTERNS AND METHODS FOR CHANGE**

The contractor will identify and describe types of pre-drinking and driving behavior patterns that precede driving while intoxicated (DWI); these will then be analyzed to determine potential intervention points or behavior alternatives that would reduce DWI. Possible techniques for changing DWI behavior

**DOT-HS-5-01271**

tions made regarding the appropriateness and feasibility of their development and application. n s

Psychometrics, Inc. 10889 Wilshire Blvd. Los Angeles, Calif. 90024  
To be completed twelve (12) months from date of contract award  
\$79,578.00

**DOT-HS-5-01271**

**DEVELOP AMBULANCE DISPATCHERS TRAINING MATERIALS**

The requirement is to expand and amplify the 1972 National Highway Traffic Safety Administration (NHTSA) publication Dispatcher: Emergency Medical Technician Training Course. Rearrangement and redevelopment of contents of that course is to result in a set of three (3) publications: a course guide, instructor's lesson plan book and a student study guide or manual.

Innovatrix, Inc. Box 371 Ingomar, Pa. 15127  
To be completed six (6) months from date of contract award  
\$22,760.00

**DOT-HS-5-01272**

**EVALUATION FACTORS FOR PERFORMANCE OF POLICE TRAFFIC SERVICES**

Analysis is to be made of job descriptions, personnel evaluation practices and procedures, and training programs of selected police agencies that provide police traffic services. The selected police agencies shall be representative of the various State, County and municipal governments. The analysis will focus on the identification of those factors, tasks and subtasks, that a line police officer at a patrolman level performs in fulfilling his police traffic service duties. Upon completion of the analysis a distillation of tasks and subtasks will be made. Those having a universality of application and that can be evaluated in terms of quantity and quality will be identified and defined.

Dunlap & Associates, Inc. One Parkland Drive Darien, Conn. 06820  
To be completed nine (9) months from date of contract award  
\$39,742.00

**DOT-HS-5-01273**

**ENGINEERING MODEL OF FUTURE MOTOR VEHICLES**

A computer program containing a compendium of engineering design and performance data on motor vehicles in service; capability for continuous updating; capability for forecasting one (1) decade, projecting and engineering model of future passenger cars; containing system interdependency functions which reflect indirect effects upon other systems when any one system is changed; integrating design and performance information from scattered sources into one (1) coherent set of data, readily accessible for all safety standard engineers to use as a uniform basis for safety studies; and, providing a precoor-

dated set of assumptions as to projected future configuration design and performance is the goal of this effort. The overall objective is to develop a comprehensive engineering model of future motor vehicles which will provide a realistic and uniform basis for developing safety requirements and assessing their future effects. 0t.

Volkswagenwerk Aktiengesellschaft 3180 Wolfsburg Germany  
To be completed twelve (12) months from date of contract award  
\$98,351.00

**DOT-HS-5-01274**

**YOUTH ALCOHOL EDUCATION MATERIAL DISSEMINATION AND PROMOTION**

The National Highway Traffic Safety Administration (NHTSA) is attempting to determine the degree of use of NHTSA's Alcohol and Alcohol Safety Curriculum, 1972, and the alcohol and driving filmstrip The Decision is Yours, 1971. The contractor will analyze all responses to a questionnaire to be sent to those persons who attended the original alcohol curriculum briefings, and will develop a dissemination plan. He shall utilize the dissemination plan to publicize the alcohol safety curriculum and the filmstrip. He shall develop and conduct an evaluation plan to determine the effectiveness of the dissemination and promotional efforts in increasing the extent and use of the alcohol curriculum and the filmstrip.

Abt Associates, Inc. 55 Wheeler St. Cambridge, Mass. 02138  
To be completed 30 Sep 76  
\$39,344.00

**DOT-HS-5-01275**

**DRIVER VISUAL LIMITATIONS DIAGNOSIS AND TREATMENT**

This study will identify the driving requirement of individuals who have poor visual capabilities; refine the visual measuring techniques to enable all potential drivers to take a fair screening test of visual capabilities; modify existing software or identify hardware requirements needed to permit diagnostic measurement of those with identified weaknesses; identify promising techniques to overcome the visual deficiencies and the driving practice limitations of those shown to have poor visual capabilities; develop preliminary standards for driver licensing officials for the screening of visual limitations; and, develop preliminary guidelines for clinicians for testing individuals with identified deficiencies. 0evc

Indiana University Foundation 355 North Lansing St. Indianapolis, Ind. 46202  
To be completed fifteen (15) months from date of contract award  
\$91,638.00



October 31, 1975

DOT-HS-5-01275

DOT-HS-5-01228 Mod. No. 1

**FIELD TEST EVALUATIONS OF REAR LIGHTING  
AND SIGNALLING SYSTEMS**

ESSEX Corporation 201 N. Fairfax St. Alexandria, Va. 22314

No change

Increased \$14,334.00

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